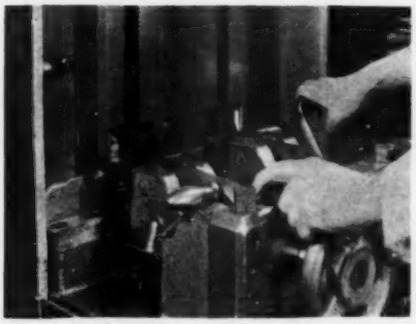
AMERICAN MACHINIST

May 3, 1939



One Stroke — *Four sides of a "Rollator" blade are finished at each stroke of this broaching machine to add precision to the Norge refrigerator (page 294)*

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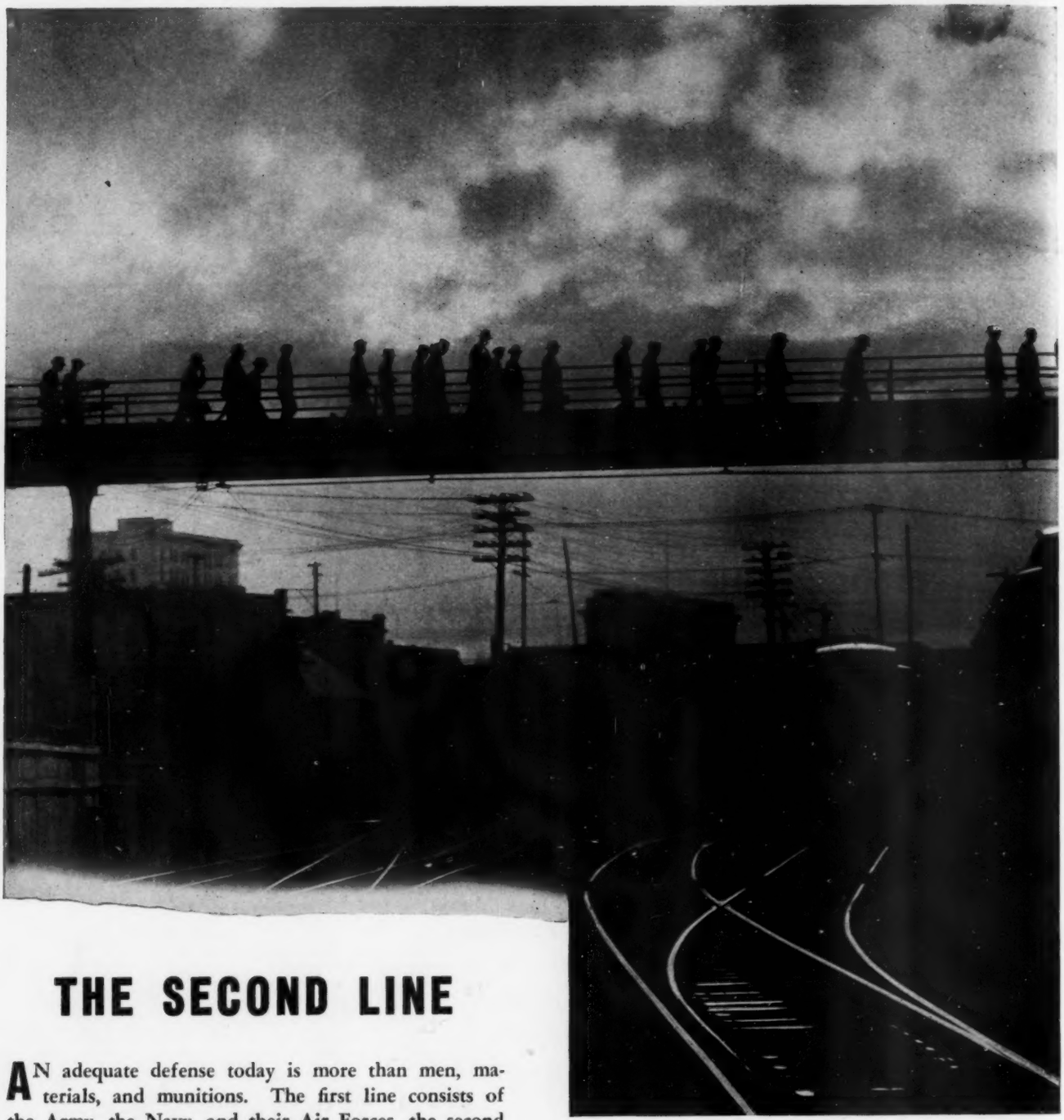


THE SECOND LINE

AN adequate defense today is more than men, materials, and munitions. The first line consists of the Army, the Navy, and their Air Forces, the second is American Industry. And it is the combination of these factors that provides a national defense.

We hear much of the first line these days—but what of the second? Is it prepared for emergency mobilization?

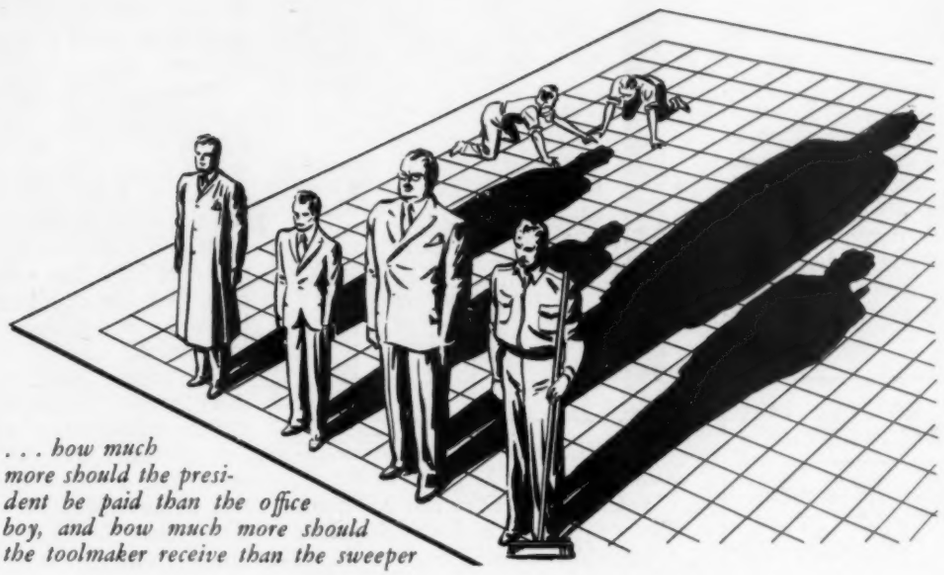
During the past four months American Machinist has presented four factual reports on national defense needs. To tie these together, to correlate these with industry's part in national defense, this year American Machinist is devoting its entire Annual Modern Plant Number to "Industrial Mobilization"—what industry is doing, can do, and should do for an adequate national defense.

This issue will be published May 31 and will contain a wealth of information of practical value to metal-working production men. It will tell the story of Industrial Mobilization—but it will tell a story that is bigger than that. For in the issue will be descriptions of methods that are applicable not only to the mobilization of industry but also to hundreds of operations in private plants. This has been the spirit of our Modern Plant Numbers. This is why the Chrysler, International Business Machines, and Chevrolet issues met with such enthusiastic response.

And this why you should watch for the May 31 issue of American Machinist—

"Industrial Mobilization", an accurate presentation of the nation's industrial preparedness.

ESTABLISHED 1877 **AMERICAN MACHINIST** BURNHAM FINNEY, Editor



. . . how much more should the president be paid than the office boy, and how much more should the toolmaker receive than the sweeper

Job Evaluation By Point Ratings

A job's worth depends on the brains and skill required to perform it plus the degree of responsibility involved

By D. W. WEED
Manufacturing General Department
Schenectady Works, General Electric Company

GREAT STRIDES have been made in applying incentive plans and in getting better time measurements. We have learned to break a job down into its elements, and we timestudy elements rather than the complete job. We have introduced motion analysis and motion economies.

The timestudy engineer is no longer an observer, but is a methods engineer first and a timestudy engineer second. We have learned that it is useless to timestudy a job that is being performed incorrectly, whether because of faulty tooling, poor servicing or poor motion economy. About everything has been said that can be said on the proper method of taking a timestudy.

Timestudy engineers must be industrial relations men; they must be able to sell to the employees the fact that their timestudies are fair and just, and they must be prepared to demonstrate to any employee that, with good effort applied properly, he can perform a given task.

But, after all, men are not paid in minutes. They are paid in money and somewhere along the line time must be translated into money so that the proper earnings for each job can be computed. It is at this point that job evaluation comes into play.

There is nothing particularly new about job evaluation. We have been evaluating jobs by one means or another since the beginning of industrial organization brought about the establishment of the first factory. The president of the company always has received more than the office boy, and the tool- and diemaker always has been paid more than the sweeper. The only point at issue is how much more should the president be paid than the office boy, and how much more should the tool- and diemaker receive than the sweeper. After all, an employee views his rate of pay and compares it with the rates

of pay on other jobs—if the rate he is receiving cannot be proved to be correct, as compared with the other jobs with which he is familiar, a potential industrial relations situation exists.

It must be borne in mind that in any plan of job evaluation there are two different phases: first—evaluating the job and, second—evaluating the employee on the job. These are two separate and distinct problems, and must not be confused. This article is confined to the evaluation of the job; methods for rating the employee himself constitute a distinctly separate problem.

The principal purposes of job evaluation are: (1) to establish proper differentials between jobs in the same factory; (2) to establish proper wage levels; (3) to establish proper rates on new jobs; and (4) to establish promotional sequence.

Unless a plan of job evaluation is so simple, so easily explained and understood, that any employee can evaluate his job after having been given proper instructions, the plan probably will be unsatisfactory.

There are two schools of thought in preparing job evaluation plans. The first is by the grading method, which usually is done by a committee that considers jobs as a whole and classifies them in grades with like jobs. Chief among the objections to this method are: (1) It is difficult to prove to any employee that his job has been placed in the proper grade, as the grading, after all, is only the joint opinion of a group; (2) As time goes on the personnel of the committee changes, and there is a likelihood of differences in ratings for similar jobs, particularly on border-line cases.

WEIGHTED RATINGS FOR JOB CHARACTERISTICS

Characteristic	*High*	*Low*
Mentality	100	0
Skill	400	0
Responsibility	100	0
Mental Application	50	0
Physical Application	50	0
Working Conditions	100	0
Base Points	400	400
Total	1,200	400

Fig. 1—Weights determined by trial and error for the governing job characteristics are tabulated here to show both the range of variable points possible with this job evaluation plan and the relative worth of each characteristic

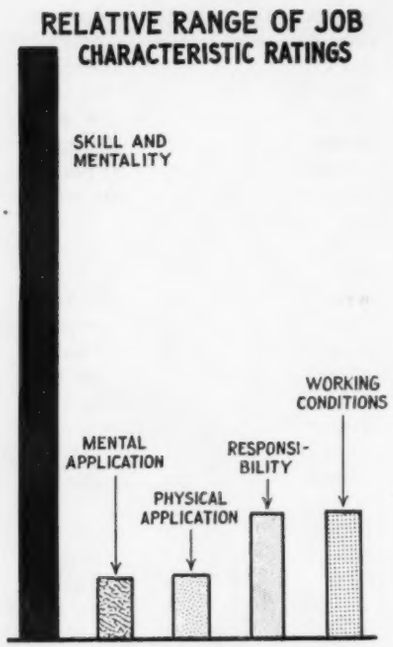


Fig. 2—Relative range of job characteristic ratings, as given in Fig. 1, is readily apparent in this bar chart. Ratings for skill and mentality have been added together in this chart, since one complements the other

The second system is the point rating method, for which the numerical point rating system which has been used by the General Electric Company for the past seven years is an example. There are several variations to this system, most of which are workable and, in the main, are satisfactory.

In evaluating factory jobs we concluded, after long study, that the compensatory characteristics are: mentality, skill, responsibility, mental application, physical application and working conditions. A discussion of each of these characteristics, as related to the work of evaluating jobs, follows:

Mentality—Our definition of mentality is: the mental capacity required by the job. Such capacity usually is gained, in the ordinary sense, through schooling. It does not make any difference whether the knowledge is gained in a formal or an informal way, but it is the mental development that an employee must have before he is qualified to do the job in question.

Skill—After consulting many authorities and checking with many of our superintendents, we arrived at the conclusion that skill can be defined best as "learning time." By this we mean the total time required on previous jobs, plus the time required on the job in question, before the employee can perform the job in an expeditious manner.

Responsibility—In evaluating the responsibility required on a job, we measured the chance of hazard or error and its probable cost in material or machinery. If a man is operating an expensive piece of equipment which is practically foolproof, the job responsibility is low. If, on the other hand, he is working with expensive materials, or with expen-

SKILL

(Modified Key List — Variable Points)

Code	*Job*	*Points*
*4512	Diemaker — First Class — Combination Dies	360
6001	Pattern Maker — Wood — Difficult	340
4511	Toolmaker — First Class — Complicated Jigs	320
6002	Pattern Maker — Metal — Difficult	300
2000	Boring Mill — 16 Ft. Magnet Frame	280
1100	Electrician — Maintenance — First Grade	260
2502	Milling Machine — Complicated Index	240
2401	Auto. Screw Machine — Incl. Set Up	220
4300	Assembler — Floor — Erect Apparatus	200
2303	Lathe — Engine — Turn For Grinding	180
2703	Drill — Radial — To Layout	160
2721	Drill — Sensitive — To Layout	140
*0910	Craneman — 200-Ton — Double Hook	120
2502	Mill Clearances — Fractional Dimensions	100
3000	Punch Press — 18-In. Armature Punching	80
*6334	Sandblast — Room — Castings	60
5102	Spray Apparatus — Supply Parts	40
1301	Laborer — Inside — Bar Stock	20
*1302	Sweeper — Remove Chips	0

Fig. 3—This modified key list indicates the variable points allowed for the skill characteristic on selected jobs. Similar key lists have been prepared for the other job characteristics

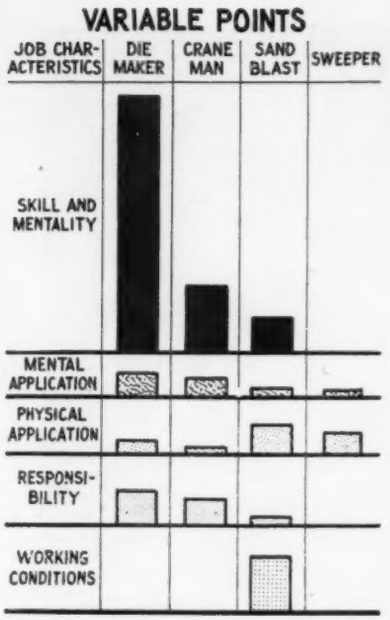


Fig. 4—Division of all variable points for the four jobs indicated with an asterisk in Fig. 3 is shown. Each job is rated separately for each characteristic by comparison with some similar job on the key list

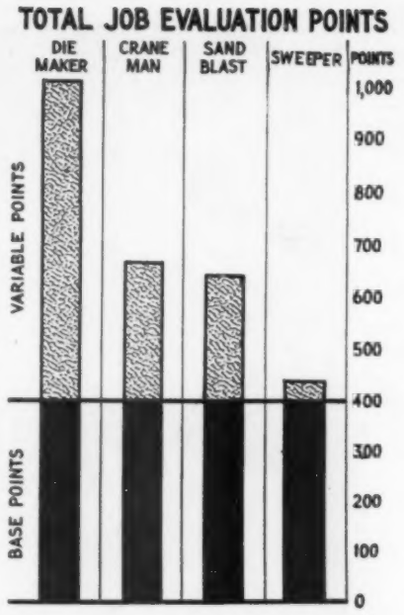


Fig. 5—A summation of the base points and the variable points shown in Fig. 4 gives the final job rating. A comparison with the master wage scale next is used to convert these total points into terms of money

sive equipment, and if, through an error in judgment he can wreck the job, responsibility is high.

Mental and Physical Application—The definition of these two characteristics is the same and, therefore, we classify them together. It is the degree and continuity of application that counts in determining the rating for each. If the job requires constant physical effort, the physical application rating is high; if it requires constant mental effort, the mental application rating is high.

Working Conditions—We do not believe that this factor constitutes a serious problem at present. The modern shop is a good place in which to work; large amounts have been expended in making workplaces safe, clean, light and wholesome. However, there are certain jobs that have hazards to health or clothing for which the employee assigned to such jobs should be compensated.

Each Factor Weighted

In setting up this system of job evaluation no attempt was made to prove or disprove any theory of wages. A survey of many firms was made to determine the experience of industry as to the worth of different jobs; with this information on hand we weighted the characteristics so as to arrive at a wage scale which was in agreement with what industry was accustomed to pay. We felt that all jobs have something in common and that we should evaluate only those parts of the jobs which differed from other jobs. In so doing we arrived, by trial and error, at the weights shown in Fig. 1. These ratings give a maximum total of 1,200 points, of which 400 are base points and 800 are variable points.

To set up a job evaluation system, such as has been outlined, it is necessary to select some 50 jobs, ranging from the highest to the lowest, and make a detailed analysis of each job, ranging them from high to low in each characteristic. After the key list is developed, the evaluation of any other job becomes simple. It really becomes a comparison of jobs, rather than an evaluation system.

Every job should be analyzed in each characteristic with respect to some job similar to it. As an example, in evaluating skill, does it take longer to learn how to do this new job than it does some job already evaluated? After you have considered a number of jobs, the job in question slips into its place without any question. This is equally true with the other characteristics. The relative rating of the different characteristics is indicated in Fig. 2. In this chart the ratings for skill and mentality have been added together, as one is the complement of the other.

A modified key list giving the variable points assigned to jobs requiring varying degrees of skill is shown in Fig. 3. A similar key list has been developed for each of the other characteristics. The four jobs marked with an asterisk in this list are shown on Figs. 4 and 5. Division of variable points for each characteristic on these four jobs is indicated in Fig. 4, while Fig. 5 shows a summation of the variable points and constant or base points for these jobs to give the total rating for each.

In Figs. 4 and 5 it will be noted that the sweeper gets practically all of his pay rating, above the base points, because of physical application; that the sand blast operator gets a large part of his pay because of adverse working conditions; and that the diemaker, craneman and sweeper get nothing for working conditions.

Assuming that the jobs all have been evaluated on the point rating system, we have a proper relationship between different jobs but we have not yet converted the points into money. To do this it is necessary that a company either adopt an arbitrary value per point which will fit their present wage scale, or develop from surveys of the wage scales of other companies a relationship between points and money that will result in the maintenance of a proper wage level.

Such surveys may be made either in the community in which the factory is located, or by making comparisons with competitors in the same line of work. It is a general practice to make these surveys in the community, as most companies wish to pay the going rate being paid in the community.

To make proper wage rate surveys it is necessary not only to have good descriptions of the jobs to be surveyed, but to have a range of jobs from the highest to the lowest. For survey purposes, it is essential that the surveyor see and analyze the jobs in the various factories being surveyed so that he can assure himself that the job descriptions he has given these factories are thoroughly understood.

It is customary to obtain the number of employees on each job with the high, low and average of the earnings of these employees. With this information at hand, weighted averages can be set up for each job and a wage scale can be drawn which will give a proper relationship between rated points and money. By so doing the factory making the survey can establish a proper wage level consistent with wages paid throughout the community for work requiring like skills.

Six blade assemblies are clamped in a holder ready for immersion successively in the flux bath at the left, the hydrochloric bath in the center and finally in the 1,800 F brazing bath of Muntz metal

Dip-Brazed Turbine Blades

Rolled sections of blades and packing pieces brazed together replace intricate milled shapes and weak assemblies

By W. H. LLOYD
Westinghouse Electric and Manufacturing Company

DIP-BRAZING turbine blades is a manufacturing process in which the blade is formed by brazing a conventional packing piece to a plain section of rolled blade stock. This method greatly facilitates forming the peg or tip-fastening on blades which are to be shrouded. It also makes possible the production of the almost endless variety of shapes on the top of packing pieces required to conform to various cylinder bores and provide smooth steam-flow paths. In some cases it would be highly impractical, if not impossible, to obtain these desired contours on the top of the packing piece by milling the blades from bar stock. Other advantages are (1) reduction in wasted material, (2) ease of assembly, and (3) accuracy in gaging, that is, obtaining proper opening between the blades for steam passage.

Round bar stock for the blades is first heated and rolled to approximate shape at a temperature above 1,650 F. It is then cooled slowly and uniformly on straightening beds, and pickled in a hot solution of 50 per cent hydrochloric acid until the scale is softened. The scale is freed by dipping the stock in nitric acid and rinsing with clean water. The stock is reheated, hot rolled to finished shape, straightened, pickled and finally cut to length.

Round bar stock for packing pieces is heated to 1,900-2,200 F and rolled to the desired section. Following this, it is heated to 1,100-1,200 F, held for a sufficient time to insure complete penetration, and then cooled slowly in the furnace. After pickling in a dilute solution of sulphuric acid to which has been added a pickle-control liquid, the stock is coated with lime and cold drawn to the size and finish desired.

The packing piece stock is cut to the desired length and milled on top to the required contour. This may be straight, at an angle, or of the so-called S-shape to obtain smooth flow lines through cylinder blading. The packing is now ready to be assembled with the blade section, which has been cut to length and pickled.

The packing piece and blade section are then fitted together by placing the convex side of the blade section firmly into the concave side of the packing piece. Both the contour of the packing and the blade must conform very closely in order that a brazing bond may be established satisfactorily. The two pieces thus assembled are spot welded together and afterwards pickled to insure clean surfaces before dip brazing.

Six of these assemblies are clamped in a holder which is immersed successively in a flux bath, a hydrochloric-acid bath, and a furnace containing brazing spelter of Muntz metal. The sequence of these movements must be coordinated so that full benefit may be obtained from the immersion in both acid and flux baths just previous to brazing. The brazing bath temperature is approximately 1,800 F.

The technique of the brazing process is quite important because slight variations of a supposedly minor nature will produce a poor bond. The brazing spelter is covered with a layer of brazing flux, and the holder of assembled blades is immersed in the bath to within $\frac{1}{8}$ in. of the top of the packing.

After brazing, the blades are heat-treated by immersion in a fused-salt bath where they remain for 20 min. after reaching 1,650 F. They are then removed, allowed to cool in still air, reheated in a bath of fused salt to 1,200 F, held there until thoroughly heated, and then air cooled.

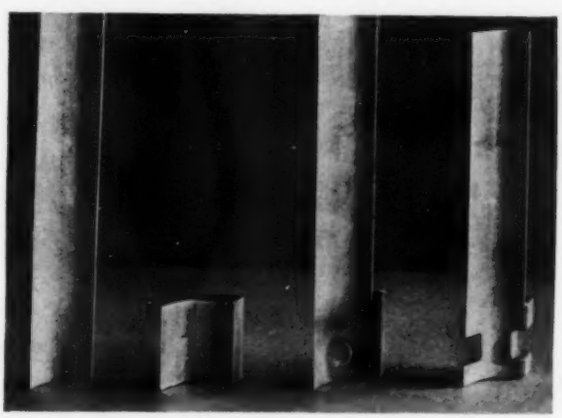
The blades are then pickled and the extra spelter removed. Following this, the blade is placed in the form anvil of a broaching machine and the bottom sides and grooves of the root are cut in one operation by progressive step broaches. The blade is then fitted to a form block on the concave surface, and the "back" or convex surface of the packing piece is milled with a form cutter. In this operation the correct angle and the thickness of pitch are obtained.

In the broaching operation enough stock is allowed on the T-shaped bearing surface to permit a radial milling operation which is the next step. When completed, the radius of the bearing surface of the blade corresponds to that of the bearing shoulders of the rotor groove. This relation for parallelism of both bearing surfaces is maintained to within 0.001 in. Distortion introduced by machining operations is removed by straightening to a box gage in which the base relation to the blade section is carefully checked.

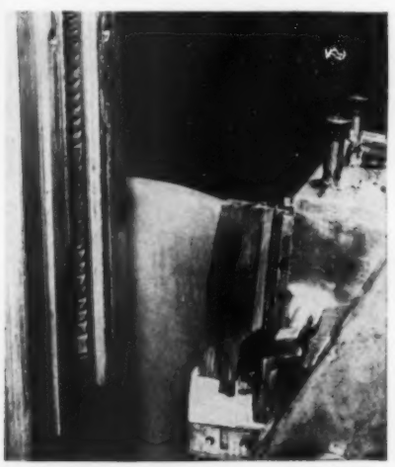
Thus far the blade section itself has been left with stock at the tip end. This is sheared to definite length. If the blade is a shrouded type, the peg is then milled; if of the unshrouded style, the profile is milled on the tip end. When profiled blades are used, they frequently are of a length to require lashing wire holes, which are drilled at this stage of manufacture. The edges of all blades thus assembled are set back from the sides of the packing so that they stand in relief as the teeth of the broach pass in broaching the root. These edges are now radiused so as to obtain the proper drop, and are blended where necessary.

The finished product is inspected for length, relation, pitch, taper, etc., by the use of finish box gages.

The brazed blades are heat-treated by immersion in a fused-salt bath for 20 min. at 1,650 F. They are then subjected to a draw heat in a similar bath at a temperature of 1,200 F



Various steps in the dip-brazing process show the rolled blade section, the rolled packing piece, assembled blade and packing piece spot welded and the finished blade



The bottom sides and grooves of the root of the brazed blades are cut in one operation by progressive step broaches. The grooves, which form the fastening, cut through both the blade and the packing piece; hence, the brazed bond is not depended upon alone to hold the blade in place

Cold Forming Operations On Stainless Steels

I—As press work on stainless becomes more common, a knowledge of the correct method of handling this material becomes increasingly important

By WALTER M. MITCHELL
Metallurgical Engineer

BECAUSE of variations in chromium content, carbon ranges and minor additions of other elements, the stainless steels present a wide range of composition and characteristic properties. As the very low chromium steels cannot be classed as "stainless", this discussion will be limited to the steels in which chromium exceeds about ten per cent.

Stainless steels may broadly be divided into three general groups:

1. MARTENSITIC — hardenable; having critical transformation ranges and carbon-chromium ratios sufficiently high to produce definite hardening on sudden cooling. These steels are especially adapted for mechanical purposes because they will develop excellent strength and toughness on suitable heat-treatment. The typical composition is chromium 14 per cent maximum, carbon 0.12 per cent maximum, with other elements, if present, not exceeding about 2 per cent. Special compositions have been developed with "free-machining" or non-seizing properties and are suitable for automatic screw-machine operations. Other special compositions contain small percentages of titanium, columbium or aluminum, either of which reduces hardenability and renders the steels appropriate for mildly corrosive conditions where an easily fabricated low cost alloy is desirable. Steels of this group are magnetic.

2. FERRITIC — non-hardenable; iron-chromium alloys with low carbon-chromium ratios that are predominantly ferritic under all conditions of heat-treatment. These steels are magnetic, possess relatively high strength, excellent corrosion resistance, and in the higher chromium ranges have high oxidation resistance. Compositions will range from 16 per cent chromium upwards to about 30 per cent, with carbon as low as melting practice will permit. Small percentages of other elements may be added to produce special properties, as nickel to restore hardenability (in which case the alloy becomes martensitic), silicon for greater oxidation resistance, etc.

3. AUSTENITIC—non-hardenable; steels with high chromium and sufficient additional elements, usually nickel, to render them austenitic at all temperatures. In point of tonnage produced and general utility this group is the most important. These steels possess high ductility for forming and drawing operations and highest corrosion resistance. They cannot be hardened by any process involving rapid cooling but may be hardened materially by cold working. They are non-magnetic in the soft (annealed) condition, but will become slightly magnetic when hardened by cold work. Compositions will range from 17 per cent chromium with nickel plus chromium 24 per cent minimum to higher ranges. Small percentages of molybdenum, titanium, columbium, silicon, or tungsten, may be added to produce special steels with individual characteristics.

Before discussing cold forming operations it is advisable to consider the various finishes in which stainless steel sheets and strip are supplied inasmuch as certain finishes are preferable for forming operations.

Stainless steel sheets are regularly supplied in the following finishes:

No. 1. Hot Rolled, Annealed and Pickled—for applications where surface appearance is of small importance, or where much forming or drawing will be necessary and original polished mill finishes would be injured by frequent annealing and pickling.

No. 2-D. Full Finish—Dull Cold-Rolled—a finish that is comparatively free from surface defects, and which, with proper care in drawing operations, can subsequently be polished to a high lustre without difficulty. This has best drawing quality for all forming operations.

No. 2-B. Full Finish—Bright Cold-Rolled. This is given a somewhat higher luster and smoother finish than No. 2-D, but drawing qualities are not quite as high. This finish is preferred for stampings and articles, such as shallow pans, that will be finished in one draw and require final polishing. This is a very smooth finish and, if not destroyed by improperly prepared dies, can, after forming, be given a high polish with one or two buffing operations.

No. 4. Standard Polished. The surface is ground with successively finer abrasives, removing all imperfections and producing a uniform, brilliant, reflective finish. This finish is regularly furnished when commercial "polished" stainless steel is specified.

No. 6. Standard Polished, Tampico Brushed. This finish is obtained by a final operation on the No. 4 finish with a rotating brush of tampi-

co fiber charged with fine abrasive, and is hence frequently called "Tampico Finish". It is a conservative soft satin finish with low reflectivity.

No. 7. High Luster Polish. This is a highly polished finish, more brilliant and reflective than No. 4, but not entirely free from scratches.

No. 8. Mirror Finish. To produce this surface polishing operations are carried through with finest abrasives, then finally buffed. This surface is brilliant, of high reflectivity, and should be free from polishing lines and scratches.

The Nos. 4, 6, 7 and 8 finishes are furnished either one or both sides polished. They are suitable only for shallow draws and forming where the original finish can be retained. Such finishes are not economical where forming, drawing, etc., will necessitate annealing and pickling, as the finish is usually destroyed in these operations.

Strip finishes are standardized, but not to an extent comparable with sheets. Strip is rarely a stock proposition and is generally rolled to order in a given width and gage to meet purchaser's requirements. Correspondingly the finish is produced for the particular job.

Nevertheless, strip finishes fall into classes which may be generalized, as follows:

No. 1. Annealed and Pickled. This is similar to the No. 1 finish in sheets, but in light gages will usually be higher in quality than the corresponding sheet finish.

No. 2. Annealed, Pickled and Rerolled. This may vary from a smooth, dull finish, similar to No. 2-D in sheets, to that corresponding to the No. 2-B finish. "High Tensile" stainless strip, used as a structural material for rail cars, airplanes, etc., is found in this group.

No. 3. Annealed, Pickled and Mechanically Cleaned. This may vary from the No. 2 to a brilliant, smooth, high luster that is almost mirror-like in quality.

Ground and Polished Finishes. Strip can usually be supplied, especially in cut lengths, in finishes similar to the No. 4, 6, 7 and 8 finishes in sheets.

In order better to appreciate the forming and drawing qualities of stainless steels the following table gives a comparison of physical properties of the various types of compositions more frequently used in drawing operations compared with those of good grade deep drawing steel, as indicated by tests on No. 20 gage sheets.

A comparison of the figures below shows that the ductility of 18-8 (austenitic), as indicated by percentage elongation and Olsen test, is greater than that of normalized sheet steel notwithstanding its higher strength and hardness; and that the ductility of 17 (ferritic) and 12 (martensitic) is somewhat less than that of normalized sheet steel. If values for other stainless steels were included in the table it would be seen that ductility and in turn drawing qualities of 25-12 are less than those of 18-8, and those of 27 per cent chromium are somewhat less than those of 17 per cent.

It will be apparent from this comparison that greater power will be required to form and draw any stainless steel than for normalized sheet steel. But it will also be evident that for severe and deep draws, austenitic steels, such as 18-8, are definitely superior to ordinary sheet steel. While the ferritic and martensitic stainless steels have somewhat less satisfactory drawing qualities, they may, nevertheless, also be used successfully in drawing operations, but cannot be drawn to as great depth in one operation.

Usually a 40 per cent reduction can be made with 18-8 before annealing is necessary; that is, a shape with diameter of 5½ to 6 in. can be drawn to a depth of 4 in. in one operation from a 10 in. diameter blank. However, various factors affect drawing operations, such as gage, condition of dies, lubricants, speed of press and surface condition of sheet, so that a 40 reduction should not be considered as standard for every case. Draws of even 50 and 55 per cent reduction are successfully made from 18-8. But in all such severe reductions it is essential that strains be *relieved immediately* by annealing; otherwise the piece may split spontaneously within a few hours. Splitting may also follow light draws, and may result from insufficient die clearance or improper lubrication.

In general, compositions with relatively high nickel have less work hardening tendency and are more desirable when severe forming and drawing operations are met.

Maximum depth of draws for ferritic and martensitic stainless steels have been found to correspond to approximately 30-35 per cent reduction. In connection with ferritic steels it is important to note that these become much more ductile and lend themselves much more readily to drawing operations if heated to about 200-300 F.

For best drawing qualities, stainless steels must be thoroughly annealed. For ordinary forming and bending, a hardness not exceeding Rockwell 85 B is desirable, but for extra deep drawing qualities hardness should not exceed Rockwell 80 B.

The selection of proper materials for dies is essential to success. Solid dies made from alloy tool steels of the non-deforming type (high carbon—high chromium) will be found highly satisfactory because of the hardness and wear resistance of these steels. Dies of ordinary cast iron may be used, but on account of rapid wear are suitable for short runs only; but alloy cast irons containing chromium and nickel may be used with excellent results. A suitable composition and its heat-treatment is the following:

	Per Cent.
Carbon	3.00—3.40
Manganese	0.60—0.90
Silicon	1.00—1.50
Chromium	0.60—1.00
Nickel	2.50—3.00

For dies with heavy section silicon should be on the low side and chromium on the high side.

Heat to 1550-1600 F., hold one hour for each one inch of section and quench in oil. Draw at 700-900 F. to give a Brinell of 280-340.

Hard cast bronze is recommended for draw rings. It has less tendency to gall and seize than steel, and re-

	Normalized Sheet Steel	Austenitic 18—8	Ferritic 17% Chrome	Martensitic 12% Chrome
Yield Point	30,000 lbs.	40,000 lbs.	40,000 lbs.	45,000 lbs.
Tensile Strength	50,000 lbs.	90,000 lbs.	75,000 lbs.	80,000 lbs.
Elongation in 8"	25—30%	45.0%	18.0%	18.0%
Olsen Cup Test	0.375—0.400 in.	0.400—0.500 in.	0.300—0.425 in.	0.300—0.400 in.
Rockwell Hardness	45—55 B	75—85 B	80—90 B	75—85 B

pair and refinishing costs are reduced.

For short runs, or for experimental work, dies make of an easily fusible or matrix metal may be used advantageously. These are cast in plaster of Paris molds and are useful for rapid preparation of dies where experiment may be necessary.

Forming machines, such as brakes and presses, rated at a certain capacity for mild steel are suitable for stainless steels about four or five gage mild steel should not be used is rated with capacity for No. 11 gage mild steel should not be used on stainless steel heavier than Nos. 15 or 16 gage. Shops contemplating the purchase of equipment to be used on stainless steel should consider this factor.

The use of draw rings is advisable whenever possible, and pressure pads must be adjusted to exert sufficient force to prevent wrinkling. Radii on draw rings should be larger than for mild steel. Excessive pressure is to be avoided in order that the metal may flow freely when necessary. Double-draw beads may be necessary on long edges of such articles as shallow pans. Their length and posi tion can be determined by experimental adjustment only.

Dies should be designed for a spring-back allowance of two to three times that of ordinary steel.

Dies Must Be Well Finished

Whatever the material of the dies is, it must be carefully finished. This is essential for successful operation. Radii should be as large as possible, and all roughness and scratches must be completely removed. All stainless steels have greater frictional qualities than ordinary steels and the smoother the finish on the surface of the die the more successfully can operations be performed. A well finished punch and die is particularly important in avoiding scratches and die marks when the drawn article is subsequently to be polished or buffed. Dies should always be maintained in first-class condition. At the first sign of any "pick-up" of metal, presses or brake should be stopped and the dies stoned and polished.

The adaptation of stainless steels to cold forming operations will be materially facilitated by pre-warming blanks and dies to a moderate temperature, 200-400 F., one that will, of course, not soften the die by tempering. This procedure tends to reduce work hardening and, in some cases, may be sufficient to avoid an annealing operation.

All stainless steels have different flowing qualities from mild steel and considerably greater clearances must be allowed between punch and die. Clearance should be at least twice, and in some cases three times that customary with ordinary mild steel. A good rule is to allow 15-20 per cent of the gage thickness of the metal for clearance. Naturally, the press must be rigid, and punch and die concentrically adjusted with absence of side play. Self-centering provisions for dies used in deep drawing are desirable.

The drawing speed should be somewhat slower than when drawing mild steel, a speed of 20 to 25 ft. per min. being satisfactory. In consequence, a hydraulic press, rather than a toggle press, is preferred.

Proper lubricants are indispensable in drawing and spinning operations; without them little can be accomplished. The following have been found satisfactory:

1. Lithopone and boiled linseed oil in equal parts by volume, and thinned with kerosene as necessary. To this, powdered sulphur or talc may be added for particularly difficult work.

2. White lead thinned with linseed oil to about the consistency of a heavy engine oil.

3. Castor oil and emulsified soap.

4. Lithopone mixed with water and applied in an even coat of moderate thickness. This should be allowed to dry before beginning operations.

5. Powdered graphite mixed to a thin paste with water. This to be spread evenly over the work and allowed to dry before use.

The water-soluble lubricants may be used for lighter draws and less severe work; but for deep draws, and where clearances may be scant, the oil lubricants are recommended.

All lubricants must be thoroughly and completely removed before annealing. Failure to do this will result in pitting and carburization, thereby damaging the surface and lowering corrosion resistance. Water soluble lubricants have the advantage of easy removability. Lubricants containing oils should be removed with benzine or gasoline, followed by a suitable alkali cleaning solution, such as sodium meta-silicate ($Na_2SiO_3.5H_2O$) in water at nearly boiling temperature. Articles that have been cleaned should be subsequently handled with clean gloves or tongs, as surface smears, or even finger prints, may be burnt into the steel during the annealing operation.

A method of avoiding scarring, or marking, polished surfaces of sheet or strip, in press or brake work is the application of ordinary adhesive tape to the dies. This prevents direct contact of the polished stainless surface and the dies; but obviously can be used only where the working is not severe, as in bending.

Another expedient is the use of thin paper between the polished surface and the dies. Wax paper, oiled paper, asbestos paper, and in some cases ordinary newspaper, are pasted on the polished surface, and are used with marked success for the prevention of die marks and scratches. Stainless steel sheets provided with paper protection secured with a rubber adhesive are commercially available and will be furnished by producing mills at slight additional cost. A lubricant should be used in addition to the paper.

Deep Drawing Practice

In drawing operations involving several draws, such as the formation of a narrow, deep cylindrical vessel, more operations are required with austenitic steels than with ordinary steel because of the capacity of the authentic steels to work harden. For such work the following is suggested:

Begin with a moderate draw with punch diameter equal to 60 per cent of the diameter of the blank for the first operation. The work must then be freed from grease, annealed and pickled. The subsequent draws are made deeper with punches about 20 per cent smaller in diameter for each successive operation. Cleaning, annealing and pickling must follow each draw. Should such proportionate reduction fail to produce the desired diameter in the final draw, the next to last draw may be made with a larger punch, as necessary. A small flange should by all means be allowed to remain, as it will prevent tearing. It is cut off on completion of operations.

Should conditions be such that annealing after the final draw will cause too great distortion, the last stage of reduction should be made in two separate draws. The first of these should provide that a length of 1 to 2 in. with the diameter of the last previous draw remain at the upper end of the work. The piece is cleaned, annealed and pickled, then brought to final shape by the second (actually the last) draw which is made with the same punch and die. No further annealing is then required, and finishing of the surface of the piece may proceed as desired.

Obviously the above procedure may readily be varied, depending upon the shape finally desired.

A second article on this subject will appear in an early number.

Crown Spring Simplifies Buick Clutch

BY ADOPTING a one-piece conical crown spring in its 1939 clutch, Buick has simplified the device itself and also the assembly operations. The entire clutch now has only nine parts whereas the 1938 design had 41; and of these nine parts, six are simple snap springs. One crown spring and the six snap springs take the place of a multiplicity of springs, seats, levers, pins, spacers and screws in previous types of clutches.

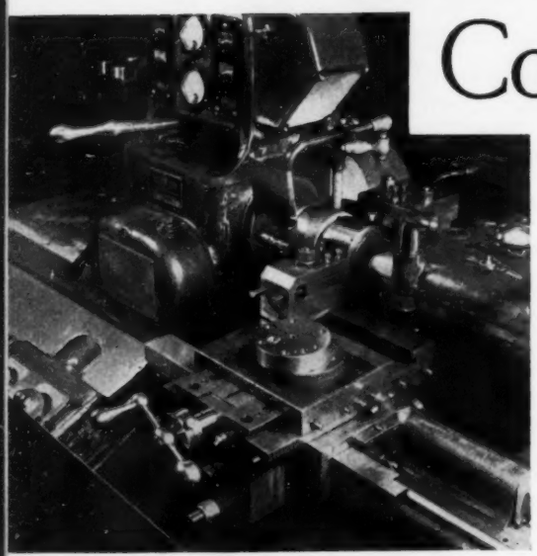
Several hundred thousand flexures in service would crack the radially corrugated crown spring if the steel were not treated to overcome a one-way grain. For this reason, Ingersoll Steel & Disc, maker of the steel, cross-rolls it as well as giving it the usual lengthwise rolling thus forming a desirable grain distribution.

As the first step in clutch assembly, the operator clamps the clutch pressure plate in an expansion chuck, lays the crown spring in place and turns the loops of the snap springs into the troughs of the radial corrugations in order to hold the crown spring in place

After the housing is dropped over the pressure plate-crown spring subassembly, two hinged quick acting eccentric clamps are swung up from opposite sides of the expansion chuck to hold the housing firmly while loops in the six snap springs are snapped over six internal lugs in the housing

Discharge-valve spring-clearance slots and oil reliefs in the valve-cover plate are milled and oil passages drilled on special LeMaire combination milling and drilling machine

Each of the six ring fixtures on this Norton Hyprolap contains ten blades for semi-finish lapping opposite edges to a surface smoothness of two micro-inches



After cutting off and drilling, the valve-cover plate is turned and chamfered on the O.D. by a Carbo hydraulic lathe equipped with Vickers hydraulic drive and control

Conditioned Precision

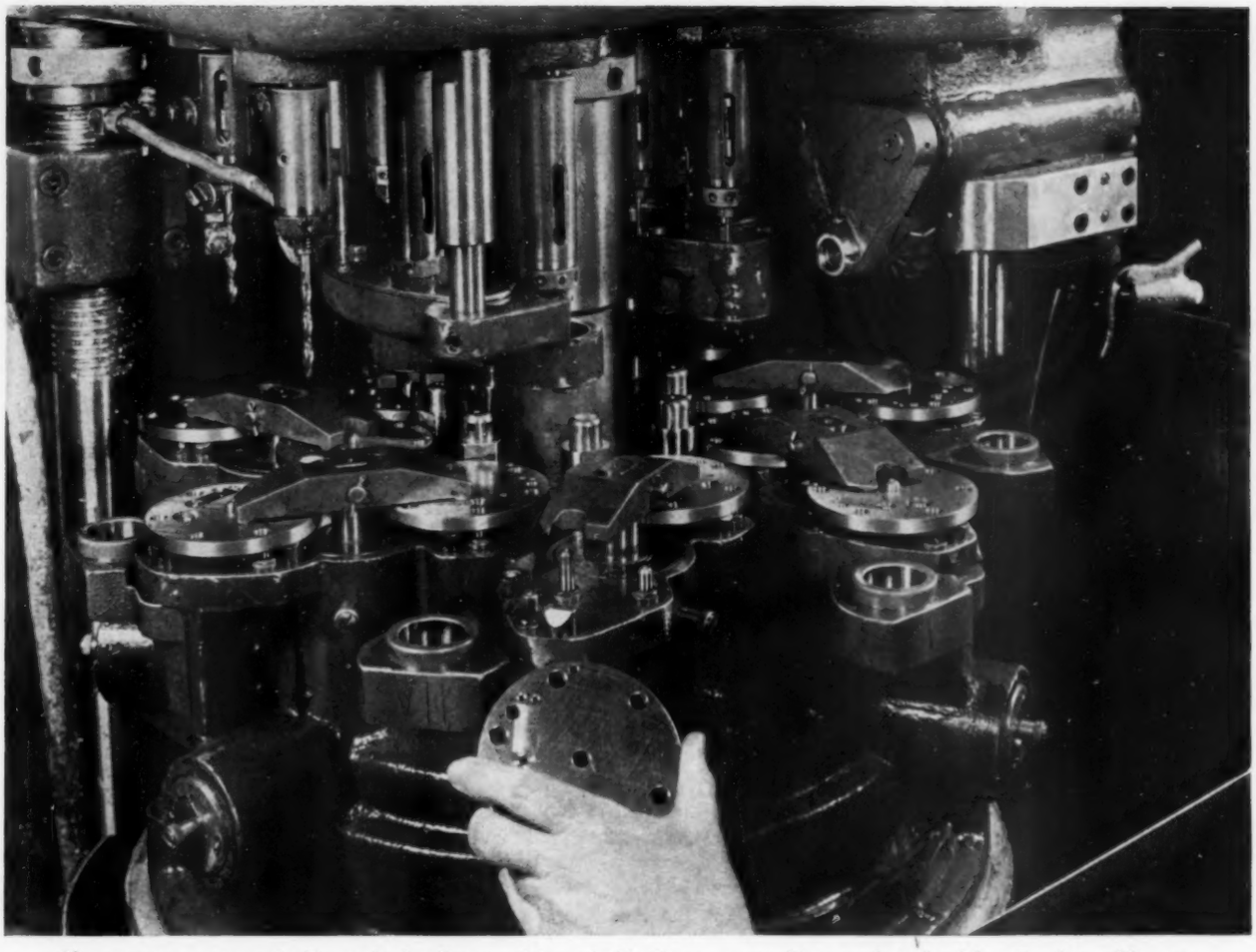
I—Dust-free air and controlled temperature aid Norge in holding close limits on refrigerator parts

By C. D. DONAVEN
Vice-President and General Manager
Norge Division, Borg-Warner Corporation

CLEARANCES between moving parts are frequently held to 0.00035 in. at the new plant set up in Detroit by the Norge Division, Borg-Warner Corporation, which produces up to 1,200 hermetically sealed "Rollator" compressor units per day. This accuracy can only be maintained through extreme care in the production processes and an extended system of selective fits for assembly.

A manufacturing program of this order requires the use of only the most modern machine tool and inspection equipment. "Roughing" operations are carried out to tolerances of one or two thousandths, and are done in open rooms.

Finish machining, on the other hand, involves working to limits of one to one and one-half ten thousandths. These operations must be done under accurate temperature control. Therefore, they are performed in a sealed room in which the temperature is always 72 F. and the humidity less than 40 per cent to prevent rusting. Filtered coolant



Clamps open automatically at the loading position of this Krueger machine equipped with a Feedex table, permitting locating the valve-cover plate over dowels. Miscellaneous holes are drilled, reamed and countersunk

is supplied to grinders from a centralized filtering and heating plant that maintains the temperature of the fluid at 70–90 F.

Inspection and assembly are done in another temperature-controlled room. A by-product of air-conditioning in both departments is the absence of dust or grit to interfere with loading work in fixtures or in assembly operations.

Control of size in finish machining is done right at the machine tool equipment by means of Sheffield visual gages. These gages are fitted with a number of attachments for transferring the measurement to the gaging head. Similar gages are used in the inspection department for making similar checks and for grading the work into size classifications. Forty-six instruments are used, half in the finish machining department and half in inspection.

Seven main parts comprise the hermetically sealed compressor unit but only three are moving parts. Each part has its own requirements for accuracy and its own tricks in manufacture. These parts are: the bearing plate, the blade, the eccentric shaft, the roller, the cylinder, the cylinder end plate and the valve cover plate. The valve cover plate and the cylinder are both forgings made from S.A.E. X-1314 steel and are soft, whereas the other five parts are S.A.E. 4620 and are hardened.

Economical and successful finishing of "Rollator" parts depends on correct balance in stock removal between rough and finish machining. A clearer idea of how half-tenths and quarter-tenths are possible in selective assembly can be obtained by following typical parts through the main production processes.

The blade, for example, is a rectangular block that oscillates in a slot in the ring-like cylinder and rides on a roller driven by an eccentric shaft. This part must be exceptionally smooth on its wearing surfaces. In the rough machining department, the blade is sawed to length and then broached on all four edges by a Colonial utility hydraulic machine. The sides must be within 0.001 in. for size. Next the flat faces are rough ground to within 0.005 in. for thickness on a Blanchard. The closer these operations are held to size, the less time required in heat-treating, because the case depth can be less. A flat is then broached on one corner, using another Colonial. Other operations produce the spring retaining holes, after which the part is heat-treated and transferred to the finish machining room.

Here the following is followed:

1. Finish grind the two flat faces to ± 0.0002 in. on a Blanchard.

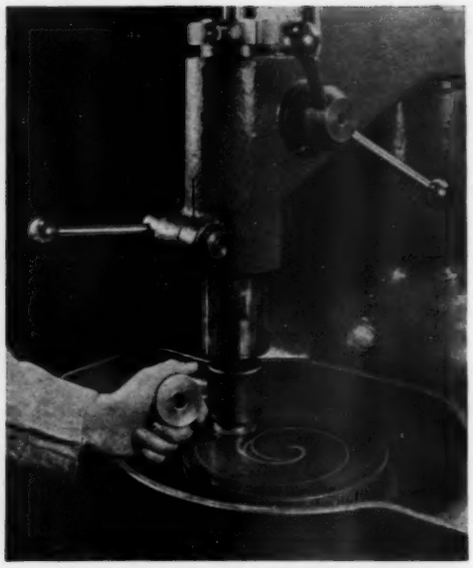
2. Hyprolap the two flat faces to ± 0.0002 in., the low limit for grinding being the high limit for lapping.

3. Load in ring fixture for surface grinding two ends or two edges to 0.0004 in. total tolerance.

4. Semi-finish lap on a Norton Hyprolap to tolerances of 0.0003 in. for thickness, 0.00025 in. for parallelism, and surface smoothness of two micro-inches, as measured on the Abbott profilometer.

5. Finish lap on a special Norge

Spindles on this Ex-Cell-O machine run fast enough to give a cutting speed of 1,500 peripheral ft. per min. at the outer edge of the valve cover plate while facing, to secure fast cutting as the tantalum-carbide tools reach the center



A pattern of compound on the lap of the special Norge finish lapping machine shows the action when finishing a roller almost optically flat and with a surface smoothness of one to one and one-half micro-inches

lapping machine to remove one-half tenth from each end. The surface smoothness is from one to one and one-half micro-inches.

6. Return to bench for relocating blades in fixture to grind and lap the other two edges square with the first two edges within 0.0001 in. The same sequence is followed as in operation 3, 4 and 5.

The Blanchard surface grinder is provided with 36 sets of fixtures for grinding several parts, there being six sets of fixtures per part.

Ring fixtures for blades accommodate ten pieces. Six fixtures are used on the magnetic chuck, thereby producing 60 pieces at once.

Norton Hyprolaps are fitted with an accurate hydraulic pressure control for the lapping head. A dial enables the operator to reset the lapping pressure to standard, and he can tell when wheels are getting dull.

Finish lapping on the special Norge machines is done with little pressure because the surface has been cut down and only half a tenth is to be removed. The lapping disk is made of special grade cast-iron. Flatness of laps is secured by the method used in producing gage blocks. That is, three laps are run together. No. 1 is run with No. 2, No. 2 with No. 3, and then No. 3 with No. 1. The last two are used in production. The lap is changed four times per day, or every 500 pieces.

In lapping on the Norge machines, the blade is placed in the recessed upper spindle and then brought down on the stationary lap on the lower spindle. Lapping compound is lightly applied to the disk and the lower lap is caused to rotate. The upper spindle head rotates and oscillates across the running lower lap and the pattern of lapping constantly changes.

One of the most difficult lapping jobs is the cylinder end plate. The part is $3\frac{3}{4}$ in. in diameter by $\frac{3}{8}$ in. thick, and has a number of holes drilled through it, plus a small annular valve seat that must lie in the same plane as the face. Even though previously ground on a Blanchard, the part will still be dished from distortion in hardening. Because the part is relatively thin, the magnetic chuck of the Blanchard pulls down the high spots and they spring back when released. Ordinarily the two high spots are on opposite sides. Therefore the lapping machine must cut down portions of the surface.

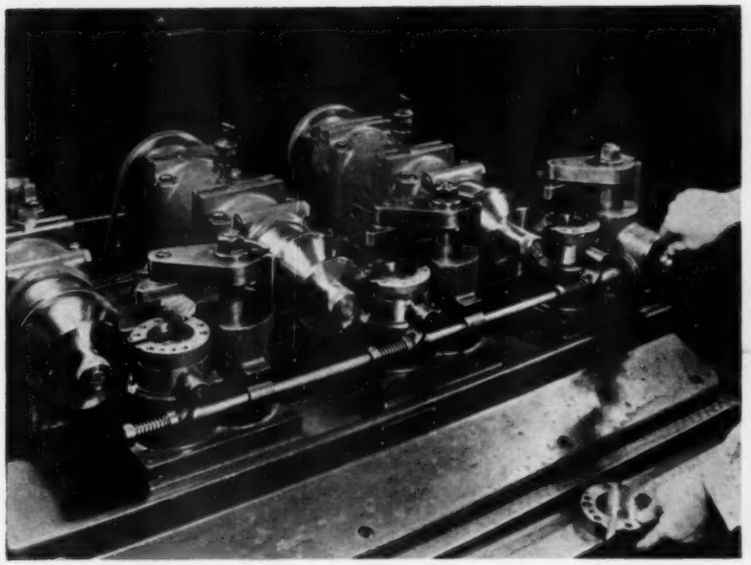
When placed on the Norge lapper, three of the parts are set in a recessed plate on the upper spindle and brought down under light pressure onto the lower lap. They are given about 70 oscillations, using 600-grain abrasive, kerosene and oil. Up to 0.0002 in. will be removed. The cylinder end plate must be flat at any position when tested with a B. & S. precision straight edge, and the valve seat must lie in the same plane as the face. Straight edges are checked at least twice a day on this operation, and laps are changed four times a day. Production is 60 pieces per hour per machine.

Precision operations on the valve-cover plate start with facing both sides on a four-spindle Ex-Cell-O. Total stock removal is 0.0010 in. Two parts are produced per cycle, two heads finishing one side and the other two heads the opposite side. Cutting speed is 1,500 peripheral ft. per min. at the start of the cut on the $3\frac{3}{4}$ in. diameter. Tantalum-carbide tools are used. Such machining speed is remarkable because of the interrupted cut occasioned by a notch in one edge of the piece and several holes in the face. The high spindle speed is necessary to achieve fast cutting as the tool feeds in to the center. Production is 70 pieces per hour, and the tolerances for size and parallelism are 0.0003 in.

The use of turning instead of grinding prior to lapping has cut lapping time in half. In grinding, a few deep scratches may occur and lapping into the base metal below ordinary scratches will be required. In machining, however, depth of the scratches is uniform and lapping into the base metal is avoided. Face lapping is done on a Norton, which removes 0.001–0.0015 in. total from both faces.

A suction valve seat below the plane of one face is machined on another Ex-Cell-O prior to lapping the faces. This valve seat is lapped on a Delta drill press fitted with a floating cast-iron lap in the spindle. The lap is dressed for every piece. The seat must hold a 30-in. vacuum.

The problem in machining the cylinder is to produce the sides flat and parallel, to size, and with the



Finish machining the cylinder slot involves an Ex-Cell-O machine with disk toolholders which run like wobble plates, and which can be set for depth of cut by 0.0001 in. graduations on the micrometer spindle collars

To cut the slot through the wall of the ring-like cylinder, the first broach on this Colonial machine cuts part way through and roughs and finishes a flat at either side of the slot, while the second broach cuts all the way through

required surface finish. The bore must be round, have a good finish, be square with the sides and to size. The through slot for the blade must be to size, have good finish, be square with the sides, and the sides must be parallel with each other.

In the rough machining department, the piece is produced from tubular stock on a Cone automatic, the operations involving boring, reaming, turning and cutting off. After normalizing the slot is broached in two steps on a Colonial utility machine.

Straddle facing on a Heald is the first precision operation in the finish machining department. Stock removal amounts to 0.005 in. per side, leaving 0.0015 in. total for lapping as the last operation. Boring is done on an E-Cell-O three-spindle machine to 0.0001 in. taper of the hole and 0.0001 in. squareness with the sides.

Finishing the slot is done on another three-head Ex-Cell-O having quick-acting clamps operated by the machine after the part is located over dowel pins in the fixture. The slot is machined square with the sides within 0.0001 in. and the tolerance for the width is $\pm$ 0.0002 in. Each toolholder is a disk that runs like a wobble plate. Two tantalum-carbide toolbits are located on each face of the toolholder. The pair for roughing and finishing one side of the slot is 180 deg. from the other pair. These toolbits are set out from the face of the toolholder by means of a master setting fixture equipped with a dial indicator. The degree of wobble for the toolholder, or increase in width of slot cut, is obtained from a micrometer spindle collar reading in 0.0001 in.

Lapping on a Hyprolap is the last operation. Smoothness is held to three micro-inches, thickness to 0.0002 in., and parallelism of the flat sides to 0.00005 in.

Production methods selected for the roller must assure that the sides are parallel and to size, and that the hole is round, straight, to size and square with the sides. The outside diameter must be to size, concentric with the hole, square with the sides and to a proper finish to prevent wear when rubbing with the blade.

After roughing on a Cone automatic, the roller is transferred to the finishing department for grinding the sides on a Blanchard. Crisscross serrations in the surface, as left by this machine, put the sides of the part in condition for rapid lapping on a Norton Hyprolap. A total of 0.0004 in. is removed in this operation, 0.0002 in. per side. Surface smoothness is one micro-inch. Flatness is consistent to one-half band with an optical flat.

The bore is ground on a Bryant chucking grinder. A total of 0.005 in. is removed, leaving 0.0002 in. for honing on a Micro-Matic. The short hole presents no difficulties in this honing operation.

The eccentric portion of the eccentric shaft is not finish ground until the rollers have been checked in the inspection department for thickness, finish and hole size. Then a shaft and a roller with the hole size classification stamped on it are put in a die-cast box and transferred via roller conveyor to the finish machining department. Here the first operation is to grind the eccentric on a Norton to suit the classification of hole size in the roller.

This machine has a double wheel set-up whereby the eccentric is ground and lapped first, and the end of shaft is ground and lapped second. There are eight classifications of roller hole sizes varying by half tenths. At the grinder the operator has a process specification chart that shows the several classifications allowable for the shaft size in order to provide a clearance ranging from 0.0003–0.00045 in. between shaft and roller. Thus, the operator must grind each eccentric within 0.00015 in. and do it at the rate of 30 pieces per hour. He is assisted in this work by a dial indicator set-up on the machine and by a Sheffield visual gage on the bench.

At the second operation, the roller is ground on another Norton with a double wheel set-up for rough and finish grinding the outside diameter to suit the rise on the eccentric. Surface smoothness is six to seven micro-inches, and is secured with a 280-grit wheel. The tolerance is three-quarters of a tenth either way. The roller and shaft assembly is set up on a Sheffield visual gage adjacent to the machine and the roller turned to check the lift.

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A second article will show Norge final inspection and assembly methods.

Thread Grinding

With an increased demand for precision threads, this method of finishing is coming into its own

By IRA J. SNADER
Research Engineer
Ex-Cell-O Corporation

IT HAS ONLY been in recent years that grinding has begun to spread rapidly as a standard finishing method for all kinds of threaded parts. Among the reasons for the recent rapid development in thread grinding are the following:

1. Increased use of heat-treated alloy steels involving the possibility of distortion, which makes thread finishing after heat-treating desirable.

2. Growing desire for higher accuracies to increase interchangeability, facilitate assembly and improve performance of machinery on which threaded parts are used.

3. Availability of reasonably priced standard thread grinders for either high-production duplication of few parts, or universal machines for quickly grinding large varieties of threaded parts.

4. Ability provided in modern high-precision machinery for producing threads to ordinary commercial tolerances at a cost frequently lower than by other methods—usually by grinding from solid stock.

5. Desire to eliminate noise in operation (as with worm gearing), making more accurate thread producing methods essential.

6. Recognition of the fact that greater accuracy of threads reduces wear and increases life of threaded parts by preventing destruction of mating threads.

7. Increased efficiency in operation of equipment due to reduced power consumption by threaded parts.

8. Easier assembly and greater interchangeability due to greater accuracy.

9. Sales advantage arising from the use of ground threads, due to the growing acceptance of the terms "grinding" and "accuracy" as synonymous.

While many of these possible advantages were recognized in the early days of thread grinding, many of them were discounted due to economic considerations; machines were expensive, difficult to set up and service, and actual grinding was slow. It was the tap industry which first adopted the new production method on a sizable scale, primarily because grinding proved to be the only feasible way of producing accurate taps of high-speed steel. Tap manufacturers largely developed their own thread-grinding equipment, although at first expensive and specialized European machines were employed.

In recent years the application of such machinery has grown by leaps and bounds. Aside from taps, a wide variety of threaded parts are today finished by grinding. These include screws, worms, odd-shaped threads, a modified buttress thread, master lead screws, aircraft cylinder barrels, crossfeed screws, internally ground threads, special chasers, airplane crankshafts, special studs, complicated threaded parts of all kinds; in fact, almost every kind of a threaded part except hobs. Each of these, in a way, presents a specialized problem. Nevertheless, manufacturers today are building standard thread-grinding machines on the same production basis as drill presses or lathes.

The evolution of these machines has probably been at a more rapid rate than in the development of most other types of production equipment. The first machine originated in Sweden and was rather crude compared with modern machine tools. Nevertheless, machines of this type did produce a great number of accurately ground threaded parts. While they were slow in operation, their basic soundness is exemplified by the fact that the most accurate precision thread-grinding machines are today built on the same principle of operation. The work spindle is driven by a worm and wheel from a reversing motor. There is a master lead screw to provide lateral motion of the work table which is supported on long ways. The work spindle runs in a closely fitted nut that is rotated in either direction to permit grinding in both directions. The grinding wheel is tilted to correspond to the helix angle of the work. There is a dresser mounted at the top of the wheel (although this type dresser did not come with the Swedish machine).

In the first redesign of this basic machine, ruggedness requirements for accuracy demanded a heavier table. Guards over the lead screw were introduced to exclude dirt. The base was made more rugged. Direct current was utilized for the work drive to enable more accurate control of work speeds for increased production. The first standard thread-grinding machine placed on the market in this country had hardened and ground ways, a very rugged base, a table operating on rollers, and wheel diameters stepped up from 6 or 8 in. to 18 in. for decreased wheel dress-

ing and lower work temperatures.

The present-day machine, has added features such as push-button controls, retracting wheel mechanism, hand wheels for controlling operation of dresser and cross slide, cams for controlling backing off as in tap grinding and a large oil cooling tank. Wheels may be dressed without slowing them down. Modern machines grind threads up to 8 in. in diameter with a full sized wheel, while larger diameters can be ground with smaller wheels.

So much for machines. Their development was paralleled by the growth in thread grinding. Each improvement on the machines was made necessary by considerations of work to be done. Similarly each improvement in turn extended the possibilities of thread grinding into new fields. Nowhere, prehaps, is there a better example of the complete interdependence of machine tools and product improvement.

Wheel Dressing

Take the matter of dressers, for intance. In German thread-grinding machines a roller, previously formed to exact thread form, is used to reform the wheel under pressure and with the wheel slowed down, the wheel being wide and having a series of grooves as a result. Unfortunately, such a set-up required the use of another machine to keep the rollers properly conditioned. In this country we now use a single-rib wheel; wheel improvement by collaboration with wheel manufacturers has resulted in increased production rates, in many cases beyond that obtainable with multiple-rib wheels.

Today the use of specially shaped expensive dressing tools (diamonds) in producing Whitworth and similar threads, has been abandoned for a number of reasons, one of which is the difficulty in obtaining correctly formed diamonds. Diamonds will wear no matter what is done to prevent it. The objective in this respect has been to make the diamonds wear "in" rather than "out." This is accomplished by using two diamonds and making one diamond move at a slightly different angle than that required by the thread form, thus generating a new point on the diamond as it wears. This regeneration is performed with the diamond moving down the side of the wheel, thus taking advantage of the well-known fact that in dressing, tools wear more on the side than on the circumference of the wheel.

The total amount of wear is only about 0.000001 in. per cut so that, at the worst, diamonds require adjusting only once every 50 dressings or so. For this adjustment a knob with graduations in ten thousandths is provided on the dresser. With this arrangement, thread forms accurate to within 0.0002 in. can be maintained continuously. This development alone—never to my knowledge achieved in Europe—has in itself justified much of the thread grinding done in this country.

Another factor which has enabled industry in this country to adopt thread grinding so widely is the removal of limitations on thread forms. Interchangeable standard cams on the latest types of universal dressers permit the grinding of practically every type or form of thread.

Next to development in machines and dressers perhaps the most important reason for the growing acceptance of thread grinding has been the cooperative development of grinding wheels. In wheels, again, this country is far ahead of Europe, particularly when you compare the productivity of single-rib wheels here and abroad.

Although similar in appearance to wheels for regular grinding, those used for thread production are considerably harder and usually much finer. The grain of the wheel varies with the pitch of the thread. For eight-pitch thread wheels of 150–180 grain, *L* to *O* grade, a vitrified wheel may be used. For finer pitches (around 20) a 220-grain wheel produces the required sharper corners. For still finer threads, wheels up to 350 grain are being used. In addition to the vitrified type, resinoid wheels are employed, being more flexible than the former. The harder, denser wheels used in thread grinding permit much higher wheel speeds (7,000 to 11,000 ft. per min.) in comparison with 5,500 ft. per min. as used in convential grinding.

Perhaps one reason for the increased speeds is that the wheels have been developed for the use with oil coolants rather than water. Oil coolants have the advantage of relatively greater freedom from vaporization due to their higher boiling points. As a result, the coolant comes closer to the point of contact of the wheel with the work. Furthermore, the oil penetrates the wheel to some extent, the depth depending on the wheel bond and density. Such penetration is, of course, highly desirable since it absolutely insures the presence of coolant at the point of actual engagement of the wheel and work. It thus serves to cool at the point of heat generation, assisting in the maintenance of lower work temperatures as well as serving as a lubricant for the cutting particles. In the latter respect, it is much superior to water coolants. In Europe, water is commonly used, although of late there has been some indication of a growing preference for oil coolants.

The matter of work temperature just mentioned has been perhaps the biggest stumbling block in the past to the extension of thread grinding.

Ex-Cell-O thread grinders are used extensively for aircraft-engine manufacture. Here is such a machine finish grinding threads on a cylinder barrel

It is obvious that when work temperature is allowed to rise materially during grinding much of the accuracy obtainable by thread grinding is sacrificed. It takes only a very slight lead error, regardless of thread-production method, to make a decided difference in the fit of the gages.

It is here perhaps that some of the greatest advances have been made. Large grinding wheels, in addition to holding their form for a greater number of threads (incidentally reducing dressing) assist in keeping the work cooler, since the wheel is given more time to cool off from the point of engagement with the work before it re-engages.

The use of large coolant tanks is a decided asset, since a greater chance for cooling is offered. The use of oil coolers, now available on thread grinders, is a further step in that direction. These are generally designed to use city water (usually about 10 deg. below room temperature) for cooling the coolant. With a suitable cooling unit and a copious flow of coolant, it is possible to maintain work temperature within 2 deg. of room temperature. Such oil coolers should be used particularly wherever long work is to be ground. A 15-deg. temperature rise will make quite a difference in the lead of a thread 24 in. long. Another contribution toward keeping the work accurate and avoiding the influence of heat on the master lead screw is by designing hydraulic mechanisms so that a minimum of oil has to be pumped to do the job. This is done by automatically varying the pressure of the hydraulic oil to suit the load imposed on the drive mechanism.

Where maximum accuracy is desired in thread grinding, care should be taken to avoid drag or difference in drag on the ways. Such variations will result in varying oil-film thickness under load and be reflected in the lead produced on the work. That is one reason why roller ways are used in modern thread-grinding equipment.

From a production standpoint, ability to operate at maximum optimum work speed is vital. If too low, production is affected. If too high, the wheel will begin to break down too rapidly. The best practice is to bring the work speed up until you just reach the rapid break-down point and then drop the speed back slightly. The machine will then be operating at maximum cutting capacity. The adjustment is quite simple since the machines are provided with infinitely variable work-speed controls. The importance of proper work-speed selection may be realized from the fact that the lead or pitch of the thread being ground completely controls the time for one traverse of the wheel. Therefore, a slight difference in work speed is reflected directly in large variations in quantities of pieces produced.

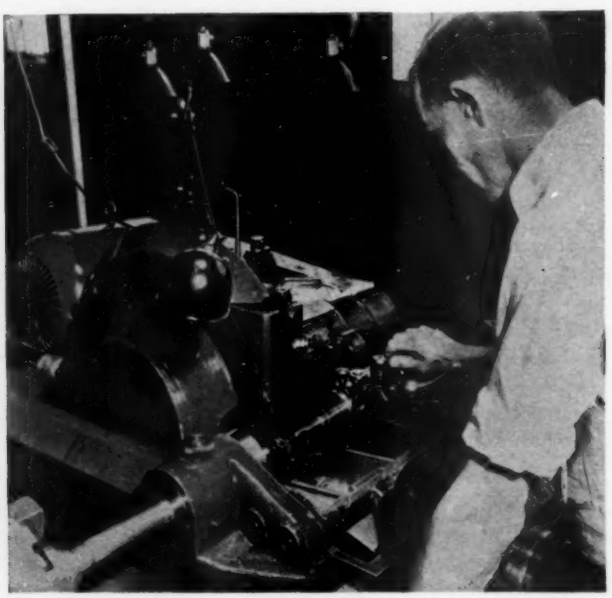
In production grinding, where roughing and finishing cuts are to be taken, it is frequently advantageous to combine rough and finish grinding on the same machine with the same wheel. Thus, in grinding taps, the sequence might be as follows: Dress wheel; finish grind, say, about fifteen taps; rough grind fifteen taps; dress wheel; and repeat the cycle. In this manner it is possible to obtain fifteen rough and finish grinds on the same machine with the same setting and only one dressing of the wheel.

Usually it is not necessary to pre-cut tap threads unless the pitch is too coarse. Taps with a pitch of ten, eleven or finer are usually ground from solid stock. Even the coarser pitches—up to eight—are sometimes ground directly from solid stock, unless production quantities are too high. In the latter case it is often more economical to pre-cut the coarser threads, leaving about 0.020 in. for grinding.

One important consideration that should not be overlooked in thread grinding as well as cylindrical grinding is accuracy of centers. In work requiring great accuracy, it is desirable to lap the centers.

While most of this article has dealt with thread grinding from the standpoint of accuracy, it should be emphasized that thread grinding is not confined to such work. Threads with commercial tolerances can frequently be produced more economically by grinding than by any other method, particularly where the pitches are not too coarse. Frequently such work is ground directly from solid stock, in some cases with only one or two passes across the work.

This machine and set-up is used by the Wright Aeronautical Corporation for finishing cylinder hold-down studs and connecting rod bolts



A thread grinder is used in the Warner & Swasey factory for finishing miscellaneous turret-lathe parts from solid stock and heat-treated blanks

Strip Location in Piercing and Blanking

Pilots, hand or automatic stops, and means to press the strip firmly against the back gage are essential to accurate relationship

By C. W. HINMAN
Tool Engineer
Kobzy Tool & Electric Mfg. Company

ALTHOUGH the principles of piercing and blanking are simple, it is often difficult to select the best and least expensive methods for the tool design and press operation. Piercing and blanking dies at times present unusual complications.

A simple progressive die is the two-station pierce and blank type shown in principle by Fig. 107. The usual stripper plate over the die is removed to expose the plan. "Step," or blanking, centers of the die and strip are the equal distance *B/C*. Section-lined holes represent section views through the punches. Round holes within the blank opening, and sectioned in reverse order, are section views through the pilot pins that protrude from the face of the blanking punch. These pilot pins register, just previous to cutting the blank, in the two holes pierced at the first station.

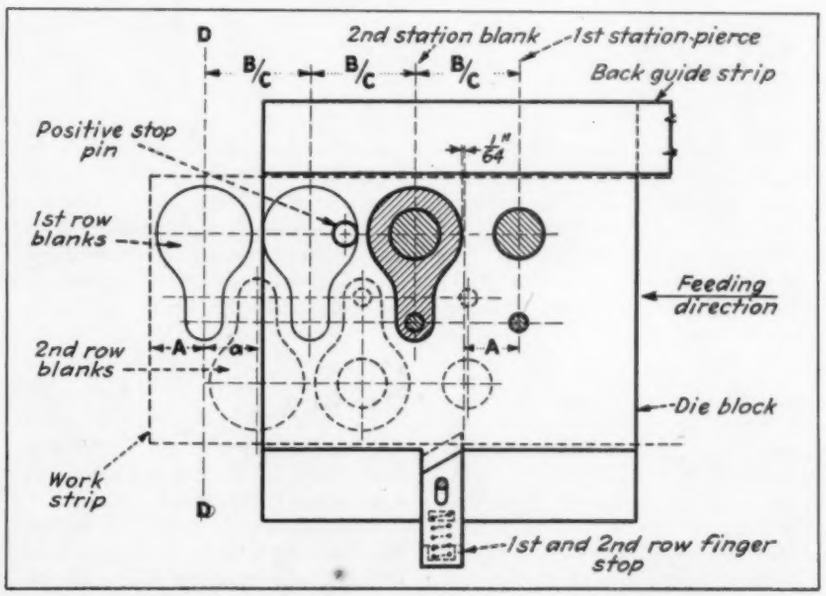


Fig. 107—If the pierced holes are not accurately located with respect to the blank outline, the press tool must be checked for construction errors

This die is designed for double-row blanking. A finger stop is necessary to facilitate entering a new strip. In this case, one stop serves for starting both rows of blanks. If the finger stop is omitted, the operator may enter the strip too far. He then cuts only a partial blank and may fracture the pilot pins, or shear and nick the punch and die edges. At other times, he may not insert the strip far enough. In either case the first blank is wasted.

When the finger stop in Fig. 107 is depressed, it withholds the forward end of the strip at $\frac{1}{64}$ in. from the nearest cutting edge of the blanking die, as dimensioned in the sketch. When the "bridge" of metal between the blanks is sufficiently large, $\frac{1}{32}$ in. or more is allowed from the blanking edge to the stop face. This allowance is intended to take care of cases in which the end of the strip is slightly out of square with its edges. But where comparatively long and narrow blanks are run bias in the strip, it is sometimes necessary to shear off one corner on the forward end of the strip to clear the blanking die and pilots. Thus, a full cut into the metal for the first blank is obtained.

When the end of the strip engages the depressed finger stop, the press is "tripped" and only the two holes are pierced. The operator then releases the stop. A compression spring forces it back, from over the die, to its normal position as shown. The strip is then advanced against the positive stop pin. The punch then cuts the first blank, with the pilots engaging previously pierced holes.

The strip is now ready to be run

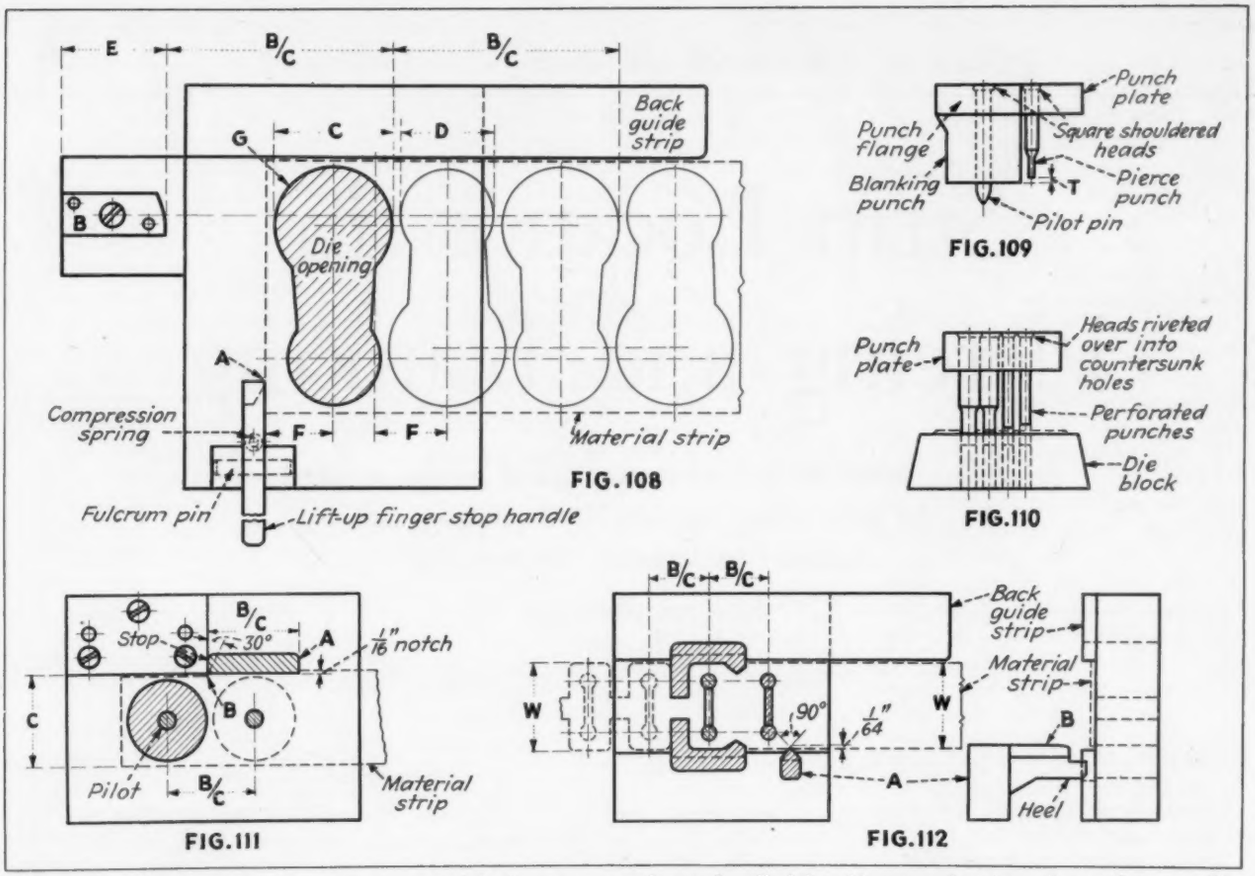


Fig. 108—Blanking operations on automobile bumper guards are handled by this type of strip and stop layout. Fig. 109—A slender piercing punch is made shorter than a nearby blanking punch by the thickness of material T, *in order to avoid deflection as the larger punch crowds the metal. Fig. 110—Deflection of punches in multiple perforating is caused by crowding the metal between holes, and is avoided by making the punches of stepped lengths. Fig. 111—Automatic stopping is secured with negligent waste of material by notching the strip edge with a punch* A *equal in width to the blanking center distance. Fig. 112—A pointed cutting punch* A *contacts the strip before any of the other punches and pushes the strip firmly against the back gage of the die*

through the die with the press "open." This means that the tripping pedal is depressed, and not released until the first row of blanks has been completed. The stop pin design can be any one of those described under Figs. 1 to 6 inclusive, (*AM*—Vol. 82, pages 761 and 762).

When the first row of blanks has been "run out", the strips are sheared on line *D—D*, making dimension *a* and *A* equal. The second row is then pierced and blanked, but from the reverse side of the strip.

A method of arranging stops for two rows of large vertical blanks is shown in Fig. 108. Here the scrap strip is in position for blanking the first row. The first and second rows of blanks are not "staggered" in the strip, as are those shown in Fig. 107. The second row is cut from alternate spaces remaining between the blanks made in the first row. Strip width is the same as used for a single row. The finger stop is normally elevated above the material strip by a compression spring. When the stop handle is lifted, the forward end of the strip is stopped at point *A*. After the first blank is cut, the finger stop is released, and the first row is run through the die.

Positive stop *B* is located to suit the blanking centers. The width of the blanked opening *C* is greater than the width *D*. Therefore, the length *E* of positive stop is made greater than *D* and less than *C*. This feature facilitates running the second row of blanks when the strip is turned over. The smaller openings *D* slide across the length of the stop, but the right-hand edge within the larger openings *C* falls against the stop and registers as desired.

Point *A* on the finger stop is located at the lower part of the blanked openings at the position where dimensions *F* are equal. When the strip is turned over to start the second row, *A* is caused to contact within the first blanked opening at point *G*, and the strip is then run through the die in the same manner as described for the first row. Blanks of these shapes favor using stops of this design.

Fig. 109 shows a slender piercing punch located close to a blanking punch edge. It is advisable to make the length of the pierce punch *less* than the length of the blank punch, by an amount equal to the material thickness *T*. This precaution avoids deflection of the smaller punch when the larger punch "sets up" a plastic deformation of the metal when starting to cut.

Both the pilot and the piercing punch are held by square-shouldered heads. This design prevents the piercing punch from pulling out of the punch plate when stripping. This type of small punch head is better than the common practice of riveting over the head into a countersunk hole as seen in Fig. 110.

When there are two or more piercing punches close together, as in Fig. 110, it is good practice to "step" the

lengths of the punches as shown. The difference between the lengths of the punches should be sufficient to prevent the crowding of metal between them when cutting.

An unusual automatic stop for light-gage material is illustrated in Fig. 111. The die openings are shown section lined. Punch *A*, provided with a backing-up heel, enters the die and cuts a notch in the edge of the strip simultaneously with blanking. Length of the notch is equal to the blanking centers of the die. The strip is then advanced for cutting the next blank, and the previously cut notch registers against the stop. Punch *A* has a small projection at point *B*. The purpose is to cut across the corner in the notch and thus prevent leaving a fin. The notch is cut a suitable distance into the edge of the strip, which may be about $\frac{1}{16}$ in. for most light-gage stock.

Both the stop and notching punch are shown at the rear of the die, but they could be used at the front edge of the strip. In "cut-and-carry" types of dies, in which the blank is notched to shape on the surface of the die, this stop can be used to advantage. The notching punch determines an accurate width of strip at *C*. In cut-and-carry dies, this feature is often important. The metal sheared from the strip for stopping is waste. But for light strips of low-cost materials, the advantages gained in die performance may offset the extra cost.

In operating blanking dies, the rear edge of the work material should contact the back guide strip across the rear of the die. This condition is imperative in all cases where the width *W* of the material strip and the width of the finished blank are equal, as seen in the cut-and-carry die, Fig. 112. In this design, the work strip is forced against the back guide automatically by descent of a heeled and pointed cutting punch *A*, just prior to piercing and blanking. The point on edge *B* is slightly curved upward, as shown, to aid in forcing back the work strip. The point on the punch enters the front edge of the stock $\frac{1}{64}$ in., and ahead of all other punches

Another device used to force the strip automatically against the back gage is given in Fig. 113. The principle involved is simply a sheaved roller, mounted on a spring-tensioned bellcrank. The roller bears against the front edge of the strip. It should be observed, however, that the pointed punch in Fig. 112 allows free feeding, while the roller pressure causes friction on the strip against the back gage. If the friction interferes with feeding, a cam punch can be arranged to free the bellcrank and roller momentarily, while the stock is being advanced. Freeing the strip momentarily is also done in automatic roll feeding mechanisms, to allow the punch pilots, in descent, to enter freely and register properly in the pierced holes of the work.

Design principles for a progressive compound die are shown in Fig. 114. This press tool approaches the cut-and-carry type. The operations shown can be performed in light-gage stock from 0.025–0.065 in. thick. As shown, *A* and *B* are the die shoe and punch holder; *C* is the die block; *D* is a spring stripper plate attached to *B*; *E* is the work strip; *F* is the blanking punch; *G* is a forming punch which carries a work-locating pilot pin; *H* is a punch that pushes the finished piece out of the strip; and *J* and *K* are spring-ejecting and forming shedders, respectively.

The shape of the blank is seen in the scrap strip above the drawing. The blank is pierced and cut in station No. 1. Pierced slugs are cut through *F* and fall out through the slanting hole *L*, which leads out at the rear. Spring plates *M* compress the shedders *J* and *K*, and upon the ram ascent they push the cut blanks back into the blanked openings in the work strip before the spring stripper plate relieves its pressure on the strip. Stations No. 2 and No. 4 are idle, but the cut blank rides over them while held in the strip. Idle stations provide a sufficient space between the die operations to allow atttaching the punches. The blank is relocated by a pilot in forming punch *G*, and is formed by punch *G* against shedder *K*, while the latter registers in the die shoe at the bottom of the press stroke.

After the work passes beyond punch *G*, a clearance channel cut in the stripper plate allows for passing along the formed-up wings on the pieces in the strip. At station No. 5, the finished work is pushed out of the strip by the descent of punch *H*, and the work drops through clearance holes in the die and shoe.

Open-faced dies, like the one shown, have no positively attached stripper plate. The work strip is guided through slots in vertical plates attached at the ends of the die. If the work strip is not mechanically fed, a vertical automatic finger stop can be placed at the left of punch *H*. This type of compound die is a high-speed tool suited to fabricate small parts from thin-gage materials.

Part 20 of Mr. Hinman's series will appear in an early number.

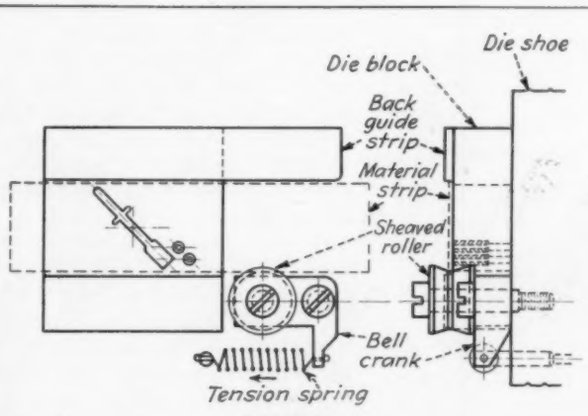


FIG. 113

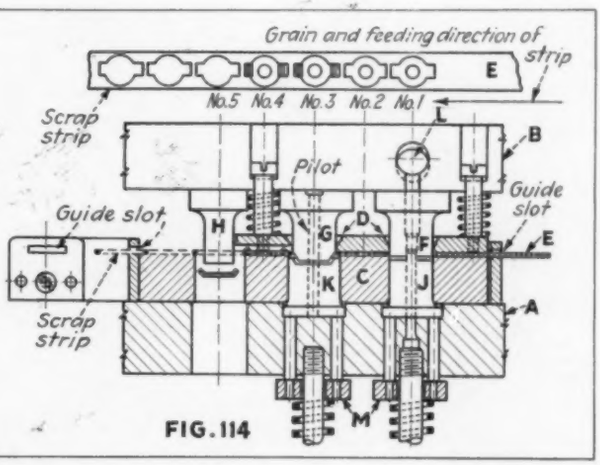


FIG. 114

Fig. 113—A sheaved roller can also be used to push the strip against the back gage, but the friction set up may interfere with feeding. Fig. 114—Idle stations No. 2 and No. 4 allow sufficient space between die operations to allow attaching the punches in this progressive compound die

IDEAS FROM PRACTICAL MEN

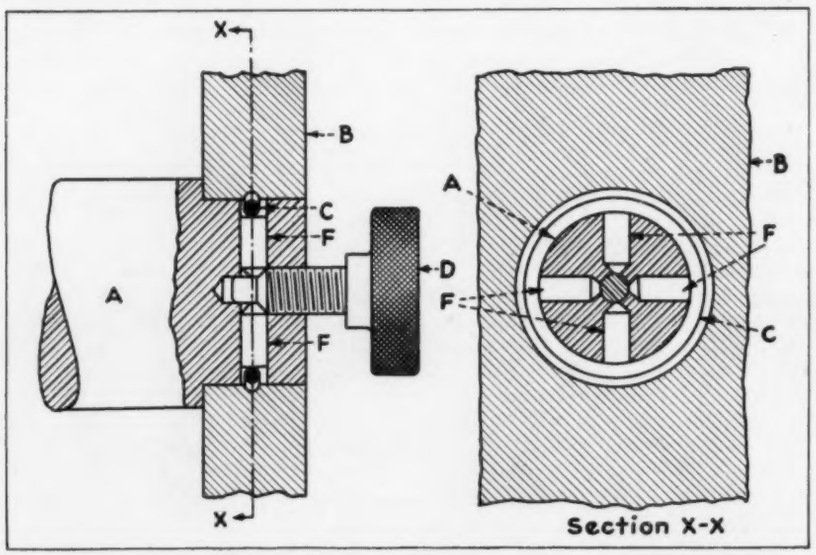
Quick-Acting Locking Device

By L. KASPER

In a machine for making a wire product, the short, stationary shaft *A* had to be removed at frequent intervals to provide access to parts that needed adjustment. To permit quick removal and replacement of the shaft, the device illustrated was adopted.

The shaft is shouldered to fit in its supporting member *B* and the reduced part is grooved to receive the split ring *C*. The knurled-head screw *D* is axially threaded in the end of the shaft and its tapered part makes contact with the conical ends of the four radially disposed pins *F* which slide in radial crossholes in the shaft. The hole in which the reduced part of the shaft fits has an annular groove of a depth equal to one-half the diameter of the wire of which the split ring is made.

In the position shown in the illustration the shaft is ready for removal and the entire assembly can be withdrawn from the hole in the supporting member. To lock the shaft in place the knurled-head screw is turned in, its tapered part contacting the inner ends of the four pins and causing them to move outward. The outward movement of the pins forces the split ring to expand and bottom in the annular groove in the hole of the supporting member, locking the shaft in place. Turning the screw out disengages its tapered part from contact with the inner ends of the four pins and permits the split ring to force them inward and to collapse into the groove in the shaft, unlocking the shaft.



A split ring is forced outwardly into an annular groove in the supporting member by four pins actuated by the tapered part of the knurled-head screw

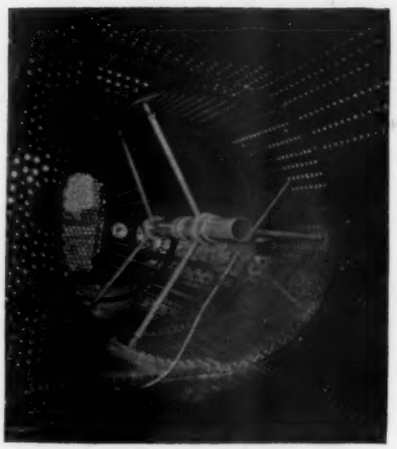
"All-around" Old Man

By FRANK C. HUDSON

"Old Men," that back up air or electric drills, are made in various designs and for many purposes. Here is one that has an all-around usefulness, at least it makes it easy to drill holes all around the boiler shell.

The design consists of a good sized central tube with two sets of radial arms, three in each set. These arms each have adjustable screws in the end, the ends being pointed, and hardened, so as to bite into the sheet and hold firmly after being set in place.

With the central tube located in



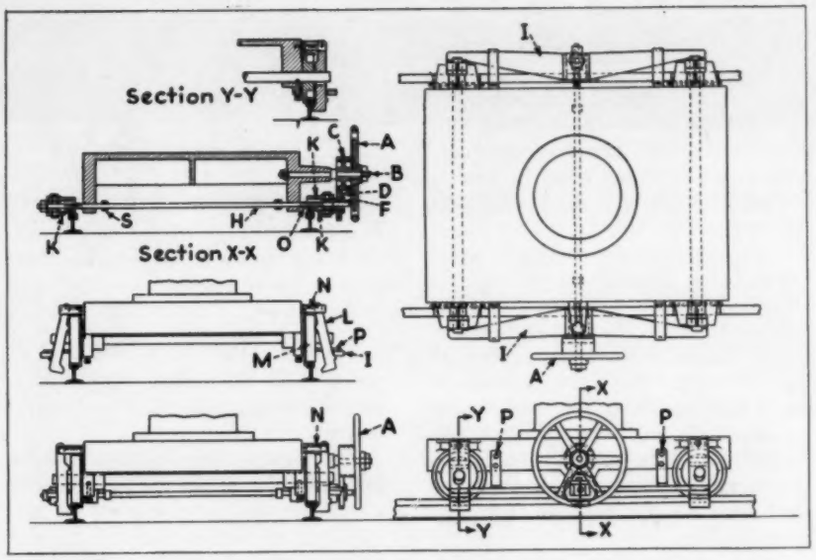
position as shown, it is easy to place the drill in any position and to reach any part of the shell desired. Having the large tube properly centered and using care to position the drill, it is easy to insure that the holes are radial. It is quite probable that a similar design could be used in other work.

Truck Takes Machine to Work

By A. DUNTON
Lachine, Quebec, Canada

In the illustration is shown a truck used to transport a radial drill to different stations on large, heavy work where it is easier to move the machine than the work.

For convenience, a central location for clamping the truck to the rails has been provided by which all four corners of the truck are securely clamped. The clamping mechanism is operated by the large handwheel *A* which revolves freely on the stud *B* and has a gear *C* attached to its hub which meshes with the gear *D* below. In the hub of gear *D* is keyed the bronze nut *F* which engages threads on the floating clamping rod *H*. When the handwheel is revolved clockwise the nut in the hub of gear *D* moves the floating rod endwise and actuates the clamp arms *I* by means of studs in the sleeves *K*. The clamp arms, in turn, draw the lower ends of the clamps *L* inward, hook-



The truck is securely anchored to the rails by clamps actuated by clamp arms and a floating clamping rod when the large handwheel is revolved clockwise

ing them under the railheads where their inclined faces pull the axles down on the rails.

Each clamp arm actuates two clamps and equalizes the pressure between them. The clamping pressure on all four corners of the truck is automatically equalized by the endwise movement of the floating clamping rod, the endwise floating of which is made possible by the teeth of the narrow-faced gear *D* being free to slide in the tooth spaces of the wider faced gear with which it meshes.

The truck has two non-rotating axles on which the flanged wheels *M* revolve freely, and on extensions of which the clamps are hung and are free to rock. The wheels have large diameter inner bosses bearing against machined faces on the sides of the truck which take the side thrust from the clamps while the truck is clamped to the rails, the clamping pressure being transmitted through the wheel hubs to the machined faces on the truck, thereby acting as a brake on each wheel.

When the handwheel is revolved counter-clockwise, tension springs *N* loosen the grip of the clamps on the rails and compression springs *O* on the floating clamping rod push their lower ends outward far enough to clear the splice bars at the rail joints, as shown in the end elevation where the clamps are free from the rails.

The retainer arms *P* keep the clamp arms in correct relation to the clamps. The stop collar *S* on the floating clamping rod bears against the inner bearing of the rod when the clamps have been fully withdrawn from the rails. Its purpose is to divide the clearances equally between the clamps and the rails when the truck is unclamped and is ready to be moved. It is so positioned on the rod that the clearances between the clamps and the rails are all equal on the complete release of the clamps.

Jig Boring Faceplate

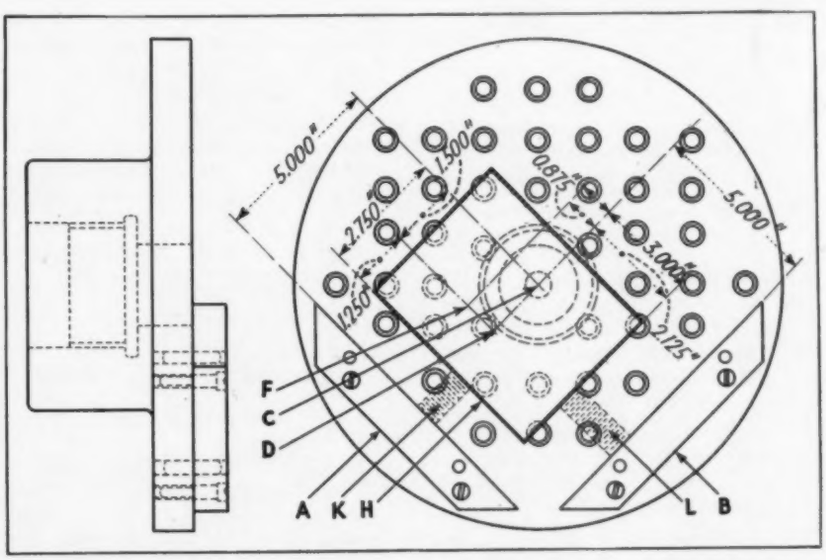
By VICTOR SILBER
Manager, Special Machine Tool Engineering Works, Inc.

The lathe faceplate illustrated was designed for boring bushing plates for drill jigs in which the center distances of the holes are to be held within a tolerance of 0.001 in.

The plate is made from a good grade of cast iron and was rough machined all over and seasoned before being finished. The outer part of the central hole was bored to 2.000 in. in which a hardened and ground steel plug was fitted. Before using the device, the shoulder of the spindle was refaced to insure that the faceplate would run true.

Attached to the faceplate by screws and dowels are the two pack-hardened and ground base blocks *A* and *B*. In assembling them to the faceplate, the dowel holes were not drilled and reamed in the faceplate until after the base plates had been set accurately square with each other. They were first set so that the distance from their inner faces to the center of the lathe spindle was about 0.015 in. less than the specified distance of 5.000 in. Then they were removed and their inner edges were ground to bring them the specified distance as measured by Jo blocks from the 2.000-in. plug.

The method of locating the bushing plate for boring the holes is quite simple. Assume, for example, that three $\frac{5}{8}$-in. holes at *C*, *D* and *F* are to be bored in the bushing plate *H* at the given center distances from each other and from adjacent edges of the plate. Having the necessary dimensions, the center distance of each hole from adjacent edges of the plate is subtracted from the 5.000-in. center distance between the spindle and the inner edges of the base plates. Having found these distances, Jo blocks of the same value



By the use of this special faceplate in conjunction with the necessary Jo blocks, the lathe is virtually converted into a jig borer

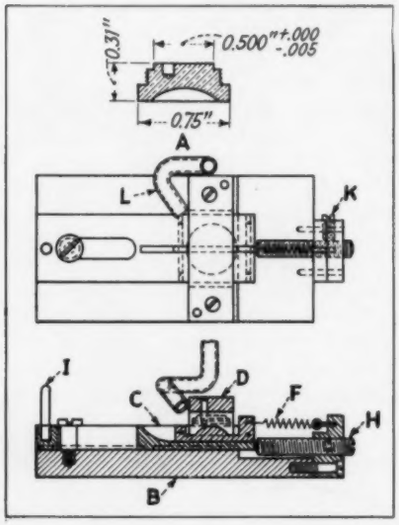
are put between adjacent edges of the bushing plate and the inner edges of the base plates. Thus, for locating the bushing plate for boring hole *C*, the Jo blocks required at *K* are 2.250 in. and at *L*, 2.875 in. For hole *D*, 3.750 in. at *K* and 2.875 in. at *L*. For hole *F*, 3.750 at *K* and 2.000 in. at *L*.

Before locating the bushing plate, the 2.000-in. plug in the central hole of the faceplate is, of course, removed. After locating the bushing plate for boring each hole it is clamped in place and the Jo blocks are removed. Numerous holes are drilled and tapped in the faceplate for clamping screws.

Adjustable Jig

By J. A. HONEGGER

The jig illustrated is for drilling blind axial holes at predetermined varying distances from the centers of brass plugs such as the one shown



Axial holes are drilled at predetermined varying distances from the center of work in this adjustable jig. Chips are blown away by compressed air

at *A*. Essentially, it consists of the base *B*; the sliding plate *C* having a nest for the work; the hardened drill plate *D* which bridges the sliding plate; the spring *F*; and the adjusting screw *H* for adjusting the sliding plate so that the center of the work can be brought nearer to or farther away from the center of the hole in the drill plate. To insure correct orientation of the work, advantage is taken of a slot in the bottom of the work engaging a projection in the nest.

In operation, with the hole in the drill plate aligned with the drill and the jig clamped to the drill press table, the operator grasps post *I* with one hand and draws the sliding plate to the left, exposing the nest, while with the other hand he inserts the work in the nest. As pressure on the post is released the spring draws the sliding plate to the right until stopped by its end contacting the adjusting screw *H*, bringing the center of the work to the predetermined distance from the center of the hole in the drill plate for which the screw has been set, and which is locked by the binding screw *K*. As drilling proceeds, the chips are blown away by compressed air delivered through the pipe *L* from the shop air line.

Grinding Thin Washers

By J. G. MILLER

To grind very thin washers that must be flat and have their sides parallel with each other is generally a difficult job. They must be held on a magnetic chuck and the magnetic pull flattens them and when released they again assume their original shape.

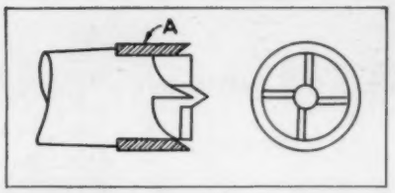
A means of overcoming the difficulty is to attach the washers to thicker pieces of steel, the sides of which can easily be ground parallel, with shellac, which dries very quickly. A weight too light to distort the washers can be used to seat them in the shellac and hold them in position until its dries. The washers can easily be removed from the steel backing by soaking in alcohol. The ground side now being flat can be held directly on the magnetic chuck for grinding the opposite side.

This method can be used for grinding washers of non-ferrous material, for the steel backing will be held to the chuck by magnetic pull. But after one side has been ground it must be attached to the steel backing before they can be turned over for grinding the opposite side.

Improved Driving Center

By MARTIN H. BALL

In the illustration is shown an improved driving center for the wood-turning lathe. As in the conventional driving center for turning wood, the backs of the driving blades are wedge-shaped and have a tendency to split the wood as it is being



The beveled edge of the ring forces the fibers inward as the wood is being pressed on the center, preventing it from splitting.

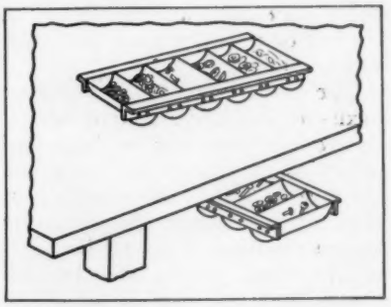
pressed on the center unless prevented by some type of restraining means.

The improvement consists in turning down the outside of the center to a shoulder and shrinking on the ring *A*, the front edge of which is beveled at an angle of 45 deg., the bevel sloping inward. As the wood is being pressed on the center, the beveled edge of the ring compresses the fibers and prevents the stock from splitting.

Receptacles for Small Parts

By CHARLES H. WILLEY
Superintendent of Manufacturing
Hoyt Electrical Instrument Works

Miscellaneous small parts have a way of collecting about the work bench, either loose or unassorted in



Small round cans slit lengthwise, opened out and riveted to pieces of light angle iron make convenient trays or drawers for small parts

cans, and much time is lost in sorting them over to find the part wanted. The sketch shows a neat and simple way to take care of such parts.

Small round cans, all of one size and with the covers attached, are slit lengthwise on one side and through the ends, opened out and made into nests by riveting the ends to pieces of light-weight angle iron. The nests can then be used either as bench trays or drawers as indicated in the sketch.

Horsepower Ratings for Flat Leather Belts

By LLOYD H. SKOUGOR
Research Engineer, American Leather Belting Association

PREPARED under the auspices of the American Leather Belting Association, the following horsepower rating tables for oak tanned flat leather belting is a correlation of carefully measured test and field data. The values given in Table I do not represent peak load ratings, but are based on proper tensions and factors of safety. When these values are corrected with the factors in Tables II and III a properly designed drive will result. It is to be realized that conditions exist which may not be covered by these tables and exceptions must be made in those instances. When belt speeds are above 6,000 ft. per min. these tables do not

TABLE I—HORSE POWER PER INCH OF WIDTH

Belt Speed Feet Per Min.	*Single Ply*		*Double Ply*				*Triple Ply*	
	11/64	13/64	18/64	20/64	23/64	30/64	34/64	
	Med.	Heavy	Light	Med.	Heavy	Med.	Heavy	
600	1.1	1.2	1.5	1.8	2.2	2.5	2.8	
800	1.4	1.7	2.0	2.4	2.9	3.3	3.6	
1000	1.8	2.1	2.6	3.1	3.6	4.1	4.5	
1200	2.1	2.5	3.1	3.7	4.3	4.9	5.4	
1400	2.5	2.9	3.5	4.3	4.9	5.7	6.3	
1600	2.8	3.3	4.0	4.9	5.6	6.5	7.1	
1800	3.2	3.7	4.5	5.4	6.2	7.3	8.0	
2000	3.5	4.1	4.9	6.0	6.9	8.1	8.9	
2200	3.9	4.5	5.4	6.6	7.6	8.8	9.7	
2400	4.2	4.9	5.9	7.1	8.2	9.5	10.4	
2600	4.5	5.3	6.3	7.7	8.9	10.3	11.0	
2800	4.9	5.6	6.8	8.2	9.5	11.0	12.1	
3000	5.2	5.9	7.2	8.7	10.0	11.6	12.8	
3200	5.4	6.3	7.6	9.2	10.6	12.3	13.5	
Minimum Pulley Diam.—Inches: Belts Under 8 in. Wide	3	5	6	8	12	20	24	
Minimum Pulley Diam.—Inches: Belts 8 in. & Over Wide	5	7	8	10	14	24	30	
These are the minimum allowable pulleys for the above thickness belts.								

Belt Speed Feet Per Min.	*Single Ply*		*Double Ply*				*Triple Ply*	
	11/64	13/64	18/64	20/64	23/64	30/64	34/64	
	Med.	Heavy	Light	Med.	Heavy	Med.	Heavy	
3400	5.7	6.6	7.9	9.7	11.2	12.9	14.2	
3600	5.9	6.9	8.3	10.1	11.7	13.4	14.8	
3800	6.2	7.1	8.7	10.5	12.2	14.0	15.4	
4000	6.4	7.4	9.0	10.9	12.6	14.5	16.0	
4200	6.7	7.7	9.3	11.3	13.0	15.0	16.5	
4400	6.9	7.9	9.6	11.7	13.4	15.4	16.9	
4600	7.1	8.1	9.8	12.0	13.8	15.8	17.4	
4800	7.2	8.3	10.1	12.3	14.1	16.2	17.8	
5000	7.4	8.4	10.3	12.5	14.3	16.5	18.2	
5200	7.5	8.6	10.5	12.8	14.6	16.8	18.5	
5400	7.6	8.7	10.6	12.9	14.8	17.1	18.8	
5600	7.7	8.8	10.8	13.1	15.0	17.3	19.0	
5800	7.7	8.9	10.9	13.2	15.1	17.5	19.2	
6000	7.8	8.9	10.9	13.2	15.2	17.6	19.3	
Minimum Pulley Diam.—Inches: Belts Under 8 in. Wide	3	5	6	8	12	20	24	
Minimum Pulley Diam.—Inches: Belts 8 in. & Over Wide	5	7	8	10	14	24	30	
These are the minimum allowable pulleys for the above thickness belts.								

TABLE II—CORRECTION FACTOR FOR CENTER DISTANCE AND SMALL PULLEY

Diameter of Small Pulley in Inches	*Center Distance In Feet*															
	Up to 4 Ft.		6 Ft.		8 Ft.		10 Ft.		12 Ft.		15 Ft.		20 Ft.		25 Ft. & Over	
	Tight Side		Tight Side		Tight Side		Tight Side		Tight Side		Tight Side		Tight Side		Tight Side	
	Above	Below	Above	Below	Above	Below	Above	Below	Above	Below	Above	Below	Above	Below	Above	Below
3	0.45	0.45	0.46	0.47	0.47	0.48	0.47	0.49	0.48	0.50	0.49	0.52	0.48	0.54	0.48	0.55
4	0.5	0.53	0.54	0.55	0.55	0.57	0.56	0.59	0.57	0.61	0.58	0.63	0.59	0.65	0.59	0.66
5	0.59	0.59	0.60	0.62	0.62	0.64	0.63	0.66	0.63	0.68	0.65	0.70	0.66	0.72	0.66	0.74
6	0.62	0.62	0.63	0.65	0.65	0.68	0.66	0.70	0.67	0.72	0.68	0.74	0.69	0.76	0.70	0.78
8	0.66	0.66	0.67	0.69	0.69	0.72	0.70	0.74	0.71	0.76	0.72	0.78	0.73	0.80	0.74	0.82
10	0.68	0.68	0.70	0.71	0.71	0.74	0.73	0.77	0.73	0.79	0.75	0.81	0.76	0.83	0.77	0.85
12	0.70	0.70	0.72	0.74	0.73	0.77	0.75	0.79	0.76	0.81	0.77	0.83	0.78	0.86	0.79	0.88
15	0.73	0.73	0.74	0.76	0.76	0.79	0.77	0.82	0.78	0.84	0.80	0.86	0.81	0.89	0.82	0.91
18	0.75	0.75	0.76	0.78	0.78	0.81	0.79	0.84	0.80	0.86	0.82	0.89	0.83	0.91	0.84	0.93
24	0.77	0.77	0.79	0.81	0.81	0.84	0.82	0.87	0.83	0.89	0.85	0.92	0.86	0.94	0.87	0.96
30	0.79	0.79	0.81	0.82	0.82	0.86	0.84	0.89	0.85	0.91	0.87	0.94	0.88	0.96	0.89	0.98
36	0.80	0.80	0.82	0.84	0.83	0.87	0.85	0.90	0.86	0.92	0.88	0.95	0.89	0.98	0.90	1.00

Horsepower Ratings for Flat Leather Belts

apply and a leather belting manufacturer should be consulted. Gravity idler and pivoted motor drives with the tight side of the belt next to the pivot point are considered as having 25-ft. centers in determining a correction factor for center distance from Table II. For pivot base drives where the tight side of the belt is away from the pivot point, do not use these tables but consult a leather belting manufacturer.

To Find Width of Belt Required:

Divide name plate reading of the prime mover, or the nominal load, by values in Tables I, II and III. Width of belt = nominal load ÷ (value from Table I × correction factor from Table II × product of all correction factors selected from Table III).

To Find Hp. Rating of a Belt:

Multiply belt width by values in Tables I, II and III. Horsepower rating = width of belt, in inches × horsepower transmission capacity per inch of width from Table I × correction factor from Table II × product of all correction factors selected from Table III.

TABLE III—SERVICE CORRECTION FACTORS

Atmospheric Condition	Clean, scheduled maintenance	1.2
	Normal	1.0
	Oily, wet or dusty	0.7
Angle of Center Line	Horizontal to 60 deg. from horizontal	1.0
	From 60 to 75 deg. from horizontal	0.9
	From 75 to 90 deg. from horizontal	0.8
Pulley Material	Fibre on motor and small pulleys	1.2
	Cast iron or steel	1.0
Service	Temporary or intermittent	1.2
	Normal	1.0
	Important or continuous	0.8
Peak Loads	Light, steady load such as: steam engines, steam turbines, Diesel engines, and multi-cylinder gasoline engines	1.0
	Jerky loads, reciprocating machines such as: normal starting torque squirrel-cage motors, shunt wound D. C. motors, and single cylinder gasoline engines	0.8
	Shock and reversing loads, full voltage start such as: wound rotor (slip ring) motors, synchronous motors	0.6

TABLE IV—THICKNESS SPECIFICATIONS FOR FLAT LEATHER BELTING

Approved and Adopted by American Leather Belting Association

Medium, Single Ply, 11/64 In. Average Heavy, Single Ply, 13/64 In. Average	"All thicknesses in this table are average thickness in inches, and should be determined by measuring 20 coils and dividing this total by the number of coils measured. In rolls of belting containing less than 20 coils, the average thickness should be determined by measuring all the coils in the roll. Allowable tolerances for all thicknesses plus or minus 1/64th inch from above averages."
Light, Double Ply, 18/64 In. Average Medium, Double Ply, 20/64 In. Average Heavy, Double Ply, 23/64 In. Average	
*Medium, Triple Ply, 30/64 In. Average *Heavy, Triple Ply, 34/64 In. Average	Uniformity: No point in single belting shall be more than 3/64 inch thicker or more than 2/64 inch thinner than the average thickness. With doubles, the tolerances shall be 2/64 inch thicker or thinner than the average.

*TRIPLE PLY: These are averages for general usage. Most triple ply belts are usually constructed for particular drive conditions. *Tolerances for Single and Double Ply Belts do not apply.*

Security in Research

THREE INCIDENTS have deeply impressed me recently.

I recall my visit with the head of a small steel company. He told me how his company had pioneered in developing special steels. As other manufacturers awoke to the market for these products, competition became stiff.

"How have you met the situation?" I asked. He pointed out the window toward the company's metallurgical laboratories. "By keeping that department out there running night and day so that we can always keep a jump ahead of the other fellow in the quality of our product," he replied.

A few days later I visited with a machinery builder. He mused, "You know, it's hard to tell today what tomorrow will bring, with everything so upset. However, we've decided one thing. Our board has voted to spend plenty of money, regardless of business ups and downs, in the next year for research and development of new products. That is our best safeguard."

Less than a week passed until I had the privilege of taking the General Motors tour through the present into the future at the New York World's Fair. General Motors showed us new horizons of industry through research.

Visions of the future opened up before our eyes—visions of what may happen in the air, on our farms, in our houses, in a multitude of materials such as glass, rubber, petroleum, plastics, metals.

What of the future? Daily planes to Europe? Farms producing industrial raw materials, not food? Television as essential as the newspaper and radio? Soilless truck farms in giant bathtubs? Cities lighted by towering artificial suns? Power in smaller packages? More automatic machinery for routine tasks? Cheaper ways of unlocking light metals from the earth? New partnerships of metals to perform new tasks?

These were only a few of the future developments to conjure with. Viewed as a whole, they renewed one's confidence in the part which industry must play in the world of tomorrow, reaffirmed my opinion that research into new products and into new uses for old products is vital to companies which expect to survive in these competitive times.

In fact, the three incidents herewith recorded deepen my conviction on one point. A manufacturer can find no greater security anywhere than in keeping in the forefront with new developments designed to satisfy the wants of the people and of industry. Therein lies the security of his business.

Burnham Finney

GAGING BUSINESS

Gradual slackening of machinery business has resulted from continued war scares. Authorities expect a "breathing spell" rather than a downward trend.

Machinery business is not bad or good—just spotty. It is possible that the machine tool industry has reached an end of the upward trend which started last summer and demonstrated great hardihood through a lot of adverse news; but this does not mean a reversal—more likely a breathing spell which should last no later than September. Government orders to be released July 1 may stimulate an earlier improvement.

Domestic industrial sales were off slightly in April, and foreign orders did not take up the slack. However, this year to date has showed a wholesome progressive improvement in the ratio of domestic to overseas business. Russian buying has dropped off but there is good prospect of further sales to England, France, Holland and Japan. All in all, 1939 should average much better in domestic sales than 1938.

NEW ENGLAND—Government orders loom large in New England. The navy spent $570,000 for aircraft engines in this area. Winchester secured a good-sized army order and is in the market for new equipment. A $250,000 manufacturing building for explosives is planned for the Newport Naval Torpedo Station. Both branches of the service have bought machine tools.

NEW YORK—April in the metropolitan district has lagged behind March. Individual orders at large are being inspired mostly by the government directly through its own purchases or indirectly through orders from aircraft manufacturers. General industrial business has fallen off.

CINCINNATI—Some of the machine tool concerns here reported April business better than March, but this condition was not general. Several shops are busy almost entirely on domestic orders while others have a sizable share of overseas shipments to fill. Most of the current orders being placed are small. The need for new equipment is apparent in metalworking shops, but in many instances, it is difficult to secure release of appropriations for them.

PITTSBURGH—The falling index of steel activity is reflected in Pittsburgh's demand for new equipment. This section was below average during the first quarter, and April showed no improvement. The coal strike did not help any. However, inquiries are numerous.

CHICAGO—Household and refrigeration appliance manufacturers are busy and are ordering parts and materials. Sears-Roebuck is taking 30,000 motors a month from one company for household appliances. Equipment sales, however, are spotty with some slackening felt as compared to the first quarter.

DETROIT—Despite the flock of inquiries received earlier in the year, equipment sales continue in the doldrums. General Motors decision to limit 1939 plant investment to $10,000,000 as against $14,000,000 last year, was a blow to hopes of improved sales later. Purchasing for the corporation's new transmission plant is languishing. Other tooling programs are relatively unimportant. Loans on industrial machinery and plants are ahead of last year, and the smaller finance companies have all the business they can handle. Appliance manufacturers are just entering their busy season and report that the outlook is better than this time last year.

ROCKFORD—April sales were good in this city, with domestic orders forming a higher percentage of the total than in March. Automotive buying in connection with 1940 tooling programs and some government buying have helped operations. English and Russian purchases are reported, too. Rockford plants are rebuilding a good deal of equipment for International Harvester. There has been some slackening in the past two weeks.

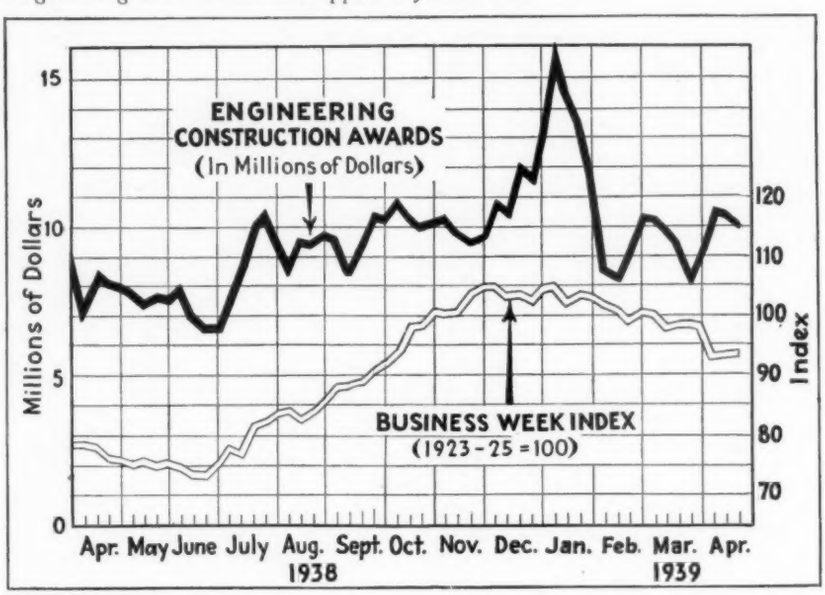
MILWAUKEE—Inquiries and incoming orders are keeping up at a satisfactory rate with April equaling the March level. There is a tendency for business to be held to a minimum because of conditions which now prevail in foreign countries.

INDIANAPOLIS—Allison Engine Company has received large government orders and is inquiring for machine tools. Otherwise business in this city is spotty.

SAN FRANCISCO—Aircraft plants are busy again and are possible purchasers of more equipment. Government orders are, of course, responsible.

ENGINEERING CONSTRUCTION VS. GENERAL BUSINESS

Despite the easing off of general business activity, the downward trend of engineering construction has apparently been arrested



NEWS OF THE INDUSTRY

Advantages of Equipment Modernization Stressed at N.M.T.B.A. Spring Meeting

Better Understanding of Machine's Effect on Employment Hoped for in Future

CHICAGO—Determination to do a better job in selling the benefits to the country of modernization of industrial equipment was a keynote of the thirty-seventh Spring convention of the National Machine Tool Builders' Association at the Edgewater Beach Hotel, April 24–25. The convention was the best attended Spring meeting in the association's history.

"We are on the eve of a better understanding of the fact that maximum employment depends on the increased use of better machinery," said Wendell E. Whipp, president of the association, in his address "Change Brings Opportunity." "From the continued widening of this understanding will soon come a real opportunity for new industrial enterprises. . . . The process of invention has not stopped, the market for new products is waiting, we need only clear away artificial obstacles to open up this opportunity." Mr. Whipp emphasized that the situation calls for a new and vigorous emphasis on sales by machine tool builders.

Introducing the "Profit Engineer"

All machine tool users should be made to realize, through advertising and direct sales presentations, that a machine tool is not so many pounds of iron and steel, but a profit maker, declared J. Y. Scott, vice-president Van Norman Machine Tool Company, in a talk on "Profit Engineering." The profit engineer is a mythical gentleman who will appear shortly in a series of Westinghouse cooperative advertisements covering case histories of profit possibilities in replacement of obsolete machine tools.

A profit engineer, according to Mr. Scott, may be a potential machine tool user, a potential investor, a machine tool salesman waiting to tell a factory manager how to save money, a treasurer demanding that the factory find ways and means of reducing the cost of the product. He may be the sales manager who says to the management, "We can sell thousands of these providing the price is so much," whereupon the factory purchases new machinery to decrease costs. He may be the banker or investment broker.

"Selling of the basic principle of profit," said Mr. Scott, "will ultimately result in the use of more and more machinery."

Greater Purchases Predicted

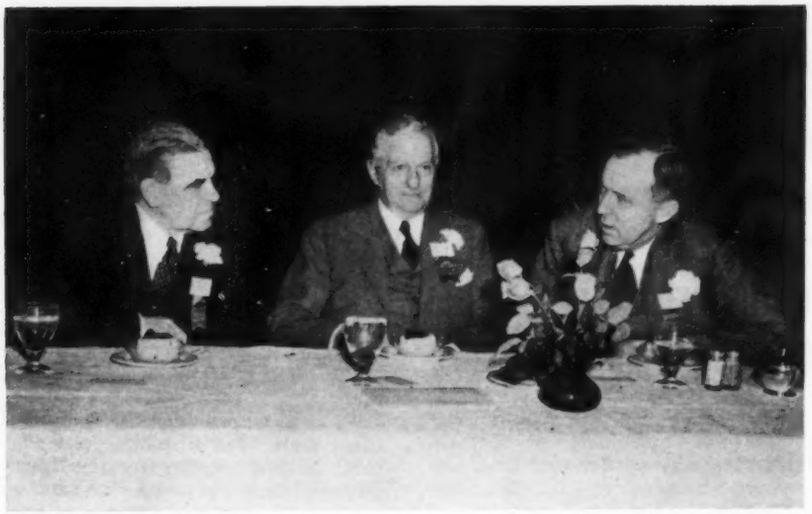
Based on its behaviour in the past, the machine tool index may be expected to recede from the March figure for domestic orders for a few months and then strengthen again as the manufacturing indexes resume a forward trend, predicted Mrs. Frida F. Selbert, secretary of the association, in an illustrated talk on the machine tool outlook. The years average, however, should be well above that of 1938. How far above it will be depends on how diligently the machine tool industry sells its products.

Mrs. Selbert stated her belief that there are no signs that the current slowing down will develop into anything more than a mild recession of three or four months duration. Government spending is likely to take up some of the slack by midsummer, particularly expenditures for national defense. Nevertheless needed machine replacements rarely are made except when the manufacturers' order books are filling up.

Analyzes Increased Tool Buying

Beginning with the last half of 1938 an important group of industries have recovered sufficiently from the 1937–38 recession to step up machine tool buying, said Mrs. Selbert. These industries build motor vehicles, electrical equipment, agricultural implements, engines, pumps, conveyors,

Machine Tool Builders Meet—*Wendell E. Whipp, right, president Monarch Machine Tool Co. and head of National Machine Tool Builders Association, talks things over with Russell T. Kelley, who addressed the luncheon group of the organization's 37th Spring meeting in Chicago. Left to right are Henry W. Wendt, chairman Buffalo Forge Co. and a director of the association; Mrs. Frida F. Selbert, association secretary; T. Herberton Doan, president Foote-Burt Co. and association treasurer; Mr. Kelley; and Mr. Whipp*



Weighty Problems—*Tell Berna, right, general manager of the National Machine Tool Builders Association, discusses "the situation" with Albert J. Gifford, left, treasurer Leland-Gifford Co. and an N.M.T.B.A. director. Looking on is Hugo L. Olson, president Sundstrand Machine Tool Co., also a director of the association*

food and canning machinery, printing machinery, foundry equipment and a miscellany of products. The laggard industries, so far as machine tool purchases are concerned, are construction and mining, office equipment, railroad equipment, textile machinery, steel mills and forge shops. The machine tool group itself has taken 8–10 per cent of the total domestic volume in the last five years.

Favors Arsenal Modernization

Over $23,000,000 will be spent by the Army and Navy for machine tools, other kinds of machinery, jigs, fixtures and gages, reported Charles J. Stilwell, new president Warner & Swasey Company, in his talk on "Planning for the Emergency." He estimated broadly that 30 per cent of the amount of money for educational orders will be spent for machine tools, dies, jigs and fixtures. That would be a total of around $10,000,000.

Mr. Stilwell pointed out the notable savings in manufacturing costs and the high rate of production attained on the shell line at the Frankford arsenal where modern machine tools have recently been installed. The Congressional bill containing $6,000,000 for new machine tools for Army arsenals is now out of the conference committee and appears certain of final approval.

For Thorough Personnel Training

"We cannot train the flexible versatile working force so necessary to our industry of tomorrow unless we insist that every capable and ambitious man is transferred from any job which has become to him routine work, for we can best stimulate his thinking and improve his skill by new experiences," said Everard Stubbs, factory manager Fellows Gear Shaper Company, in an address on "Industrial Education." "We should pick the ambitious and capable workers and stimulate their ambition and capacity by giving them work which will keep them on their toes." This will not be done unless a top executive in each company sees that the employment manager and foremen follow that policy.

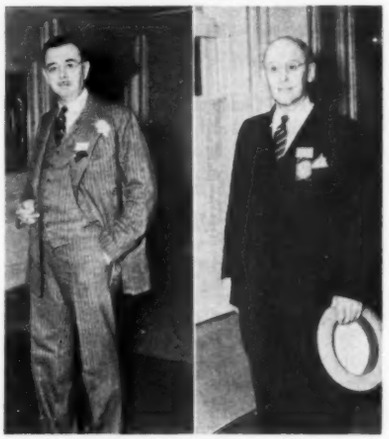
Mr. Stubbs made the point that the variety of experience of foremen, men who are familiar with all departments in the shop, will determine the quality of the future working force. Replies made by 27 machine tool companies to a questionnaire shows that 74.6 per cent of the skilled workers have had from three to four years' practical training. This seems to prove that three-fourths of shop employees in the machine tool industry must be skilled men.

In his report as general manager of the association, Tell Berna said that a new enterprise of the association is a study of sales problems and of sales promotion. Another new activity is that of the committee on electrical problems.

J. Carlton Ward, Jr., general manager Pratt & Whitney Division of United Aircraft Corporation, gave an address, illustrated by motion pictures, on airplane engines. B. P. Graves, director of design Brown & Sharpe Manufacturing Company, wrote a paper on electrical motor and control application to machine tools which was read by Mr. Berna in his absence. L. W. Scott Alter, president American Tool Works Company, gave the report of the committee on legislation.

John Abbink, president and general manager Business Publishers International Corporation, spoke hopefully on "Combating Barter Trade in South America," emphasizing that the loss of trade and of prestige by the United States has been greatly exaggerated. Russell T. Kelley, director Canadian Chamber of Commerce, discussed at a luncheon meeting the big market in Canada for machinery the next few years.

William E. Kelly, president Machinery and Allied Products Institute, described in detail what his organization has done. Ralph E. Flanders, president Jones & Lamson Machine Company, discussed briefly the machine tool outlook.



"Reporters"—*L. W. Scott Alter, left, president American Tool Works Co., reported before the N.M.T.B.A. meeting the work done by the Committee on Legislation, of which he is chairman. Everard Stubbs, right, factory manager Fellows Gear Shaper Co. and chairman of the association's Committee on Industrial Education, outlined his group's activities*

WILL REVEAL MARKET FACTS

WASHINGTON—An industrial market survey covering vital information of interest to all business men will be available for distribution this summer, according to Secretary of Commerce Harry L. Hopkins. The 1,000-page manuscript, known as the Industrial Market Data Handbook and originally requested of the Department of Commerce by the National Industrial Advertisers Associaiton, is expected to be off the presses by July 1.

The handbook is the first marketing survey of American industry that has been presented in this form. It will contain complete figures on industrial production, employment, value of products, cost of material for fuel and power for the more than 3,000 counties in the United States, and similar data for every city of more than 10,000 population.

INSIDE DETROIT

By Rupert Le Grand
DETROIT EDITOR

Shrinkage of factory worker income in 1938 and early 1939 adversely affects car sales. Toledo regains some Chevrolet parts manufacture.

DETROIT—One of the factors preventing automobile sales from equalling or surpassing those in the 1937 spring season is the lack of support from factory workers and others in low-income groups. Major finance companies find that time paper is coming as usual from the business and professional groups but that the worker is not so prone to buy a new car. These companies find that the total number of transactions are off 10–15 per cent from a year ago for this reason and also because more financing is being done through local banks and other institutions.

Factory sales of cars and trucks in the first quarter were 58 per cent ahead of the like period in 1938, but were 23 per cent lower than in the first quarter of 1937, when production was impaired by strikes. Spectacular gains by individual companies over 1938 were by and large among those supplying medium-priced vehicles. The largest producer of lowest-priced cars showed a gain of only 36 per cent as compared with the industry average of 58 per cent.

Lower Income Groups Hard Hit

The contributing reason for lack of new car purchases by factory workers and others in the lower-income groups may be traced to an impaired annual income in 1938. Many people worked fewer hours per week or fewer weeks in the year, but mostly the former in industries like the automobile industry where a genuine effort is being made to spread employment. General Motors in its annual report disclosed that the average annual earnings for regularly employed hourly paid workers in all plants amounted to $1,342 for 1938 as compared with $1,618 in 1937. After experiencing a loss in annual income of 17 per cent, it is natural for workers to hesitate over replacement of either new or used vehicles.

Figures recently compiled by the Bureau of Labor Statistics show that persons earning less than $2,000 per annum are poor prospects for annual purchases of new cars. Their annual replacement expenditure averages only $66 (see table). They are the ones who can only buy a new car as a rule in flush times and after accumulating some surplus.

It is hopeless to obtain volume sales of new cars or late-model used cars in the income group receiving under $1,000 per year. The annual replacement outlay is only $25.

PASSENGER CAR USAGE AND EXPENSE

Car Owning Families—Personal Operation Only

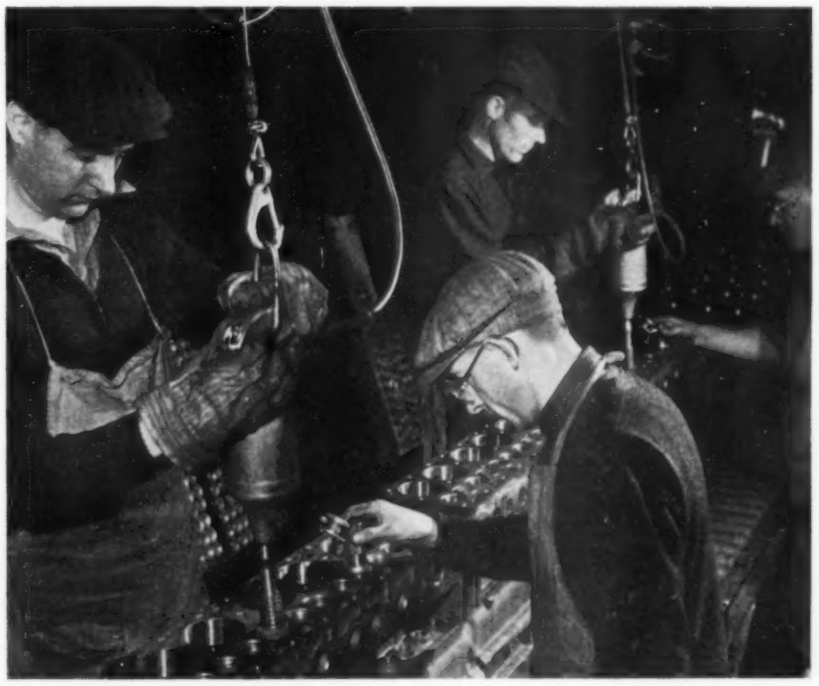
	Under $1,000	$1,000–2,000	$2,000–5,000	$5,000 & Over
Annual Replacement Expenditures	$25	$66	$152	$321
Annual Operating Cost	$45	$75	$116	$158
Mileage per year	3,000	4,700	7,200	9,700
Operating Cost Per Mile	1.5¢	1.6¢	1.6¢	1.6¢

But this survey discloses that operating cost per mile is practically uniform for all income groups. If the operating cost can be reduced by offering small low-power vehicles, the lowest income groups will eventually be able to purchase them second hand. And savings in operating cost might be applied to increasing the annual replacement outlay. Since automobile merchandising involves handling both new and used cars, the manufacturer who invades price and size fields below existing levels might find that his used-car problem would be less acute.

Since operating costs take a larger amount than replacement outlay among the two lowest income brackets, the suggestion has been advanced that automobile manufacturers provide service operations on used cars that will allow greater economy. In other words, they might provide carburetor parts and other low-cost equipment to limit performance below the original condition, in order to reduce annual operating outlay and make elderly vehicles of their design more attractive to the eventual owner.

Chevrolet Expands Toledo Activities

Chevrolet is reported to be increasing its operations in Toledo. A Mechanics-type universal joint is to be used on the 1940 model, and about 70 per cent of new-car requirements will be made in the Toledo plant. The



No Tedious Lapping—*Pontiac now grinds valve seats with a Macklin 80-Z1-60F wheel (the hardest grade) mounted on a tapered pilot that extends down into the valve-stem hole. Lapping is no longer required for a satisfactory seat. Block material is GM-M13 nickel iron of 196-228 Brinell. After seats in two blocks are ground, the wheel is removed and redressed on an automatic diamond-dressing setup adjacent to the motor line. The inspector is shown checking the concentricity of the valve seat*

balance will be made by Mechanics at Rockford.

Several years ago the Toledo plant was an important center for production of Chevrolet transmission parts, but labor disturbances forced a transfer of operations to Muncie and Saginaw. Service parts manufacture has been returned gradually to Toledo, and now the universal joint will be sent there from the gear and axle plant in Detroit. Evidently, General Motors feels that labor problems are pretty much the same everywhere now, and that it might as well make use of the Toledo facilities.

Ford Again Plans Implement Making

Ford's tractor plant is to be set up on the basis of ten units per hour. While some observers feel that this figure is a smokescreen to hide what the company is planning, other people say that Ford is displaying caution in re-embarking in the implement field. They point to the fact that both Allis-Chalmers and International Harvester have gone into production of small, inexpensive tractors in a big way, and have spent millions on tooling programs. To make a real dent in the market, Ford must, they contend, explore the field anew, establish the new product, and then go ahead with expansion of production. Some equipment in the Rouge is to be rebuilt to suit tractor parts, which is another indication that Ford is not going the whole hog at once.

APRIL MARKS AUTO SALES PEAK

DETROIT—April sales of passenger cars and trucks will probably total between 340,000 – 350,000 units. March sales amounted to 330,000 units. The outlook for May is that some of the major producers will cut assemblies by 10–15 per cent from April levels, thereby establishing that the spring bulge has been reached and that the sales curve is slowly turning downward.

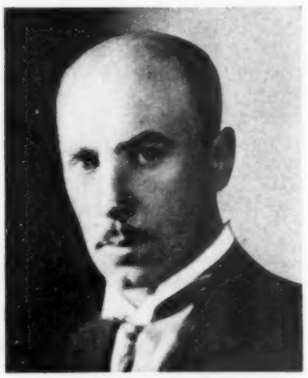
DANGER OF AIR ATTACK ON U.S. MINIMIZED BY IGOR SIKORSKY

NEW YORK—At the first "Spring Round-Up," held by the Metropolitan Section of the American Society of Mechanical Engineers at the Hotel Astor, April 20, Igor I. Sikorsky, chief engineer, Sikorsky Aircraft Division, United Aircraft Corporation, discussed the role of the airplane in modern warfare.

He pointed out the extent of the damage which might be inflicted behind enemy lines by systematic bombing creating channels of destruction to divide large cities in two. Power plants and railway facilities would be special targets of attack, thus crippling the sources of supply to troops at the front. However, Mr. Sikorsky stated, the United States has little to fear from such attacks from abroad with the present state of aircraft development.

The Spring Round-Up, an innovation in Metropolitan Section activities, was designed to keep the membership informed as to the broad picture of industrial progress. Eight speakers each presented a particular phase of industry. P. E. Frank, Sinclair Oil Corporation, presided.

In an address on the developments in machine shop practice, John Haydock, managing editor, *American Machinist*, showed that the United States has lagged behind Germany in its equipment modernization program. The Army Arsenals, the Navy Yards as well as the privately owned industrial plants have a big task ahead to put themselves in position to meet a national emergency.



IGOR SIKORSKY

E. G. Bailey, vice-president, Babcock & Wilcox Co., president, Bailey Meter Co., spoke on new trends in power generation. Hydraulic power development was described by A. T. Larned, Phoenix Engineering Co., who gave many examples of recent construction.

Methods and problems of modern management were discussed by Robert M. Gates, vice-president, Combustion Engineering Co. Lewis Ketchum Sillcox, vice-president, New York Air Brake Co. gave his slant on the future of American railroads.

Lt. Col. Oliver F. Allen, U. S. Army Reserve, retired, spoke on sanitation, giving a description of some of the latest sewage disposal plants. Merrill C. Horine, Mack-International Motor Truck Corporation, had for his subject the problems confronting the motor vehicle engineer.

Following the industrial session, a dinner was attended by some 700 members and guests. The speaker was Professor Alexander Graham Christie, Johns Hopkins University, president of the A.S.M.E. He called for "An Engineering Way Out" of business depression by recommending industrial peace and the promotion of new inventions to aid employment and increase living standards.

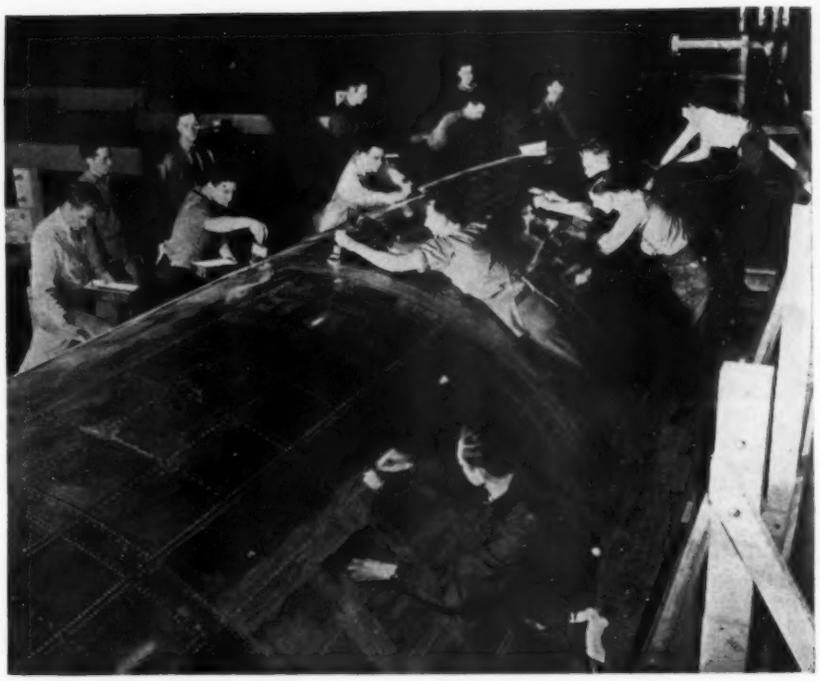
Envision "World of Tomorrow"—*Thomas H. MacDonald, chief of the U. S. Bureau of Public Roads, second from left, discusses highway progress for the future with executives of General Motors at a dinner dedicating the corporation's "Highways and Horizons" exhibit at the New York World's Fair. Left to right are Charles F. Kettering, G.M. vice-president; Mr. MacDonald; William S. Knudsen, G.M. president; and Alfred P. Sloan, Jr., G.M. chairman*

INITIAL EDUCATIONAL ORDERS AWARDED TO SIX COMPANIES

WASHINGTON—President Roosevelt has approved the award of contracts to six manufacturing concerns for educational orders under the act of June 6, 1938. These contracts will utilize the entire $2,000,000 made available by Congress for 1939.

Goodyear Tire and Rubber Co. obtained the contract for the gas mask; Winchester Repeating Arms Co., for the new semi-automatic rifle; General Electric Co., for the searchlight used by the anti-aircraft artillery; R. Hoe & Co. for the recoil mechanism for the new anti-aircraft gun; S. A. Woods Machine Co. for machining 75-mm. shells; and American Forge Co. for 75-mm. shell forgings.

The designs, specifications, and drawings, may be reviewed to determine if the Army designs are completely adapted to mass production. The contractor will then buy or manufacture such special machinery, dies, jigs, and gages as are necessary. He will then manufacture only a sufficient number of the items to assure that the engineering work and the equipment provided are satisfactory.



Blowing Bubbles—*Workmen atop the fuselage of a new Boeing "Stratoliner" cover all seams with a soap film as air pressure is built up inside, bubbles revealing the slightest leak. Sealed cabin of this ship, built for Pan-American Airways, provides normal atmospheric pressure for passengers at high altitudes*

U. S. Government Contracts Awarded to Metal-Working Firms

(Awarded from April 3-15, inclusive)

Contractor	Gov't Agency	Commodity	Amount
Midvale Co., Philadelphia, Pa.	Navy, S. & A.	Steel forgings	226,325
Hart Mfg. Co., Louisville, Ky.	War, Q. M. C.	Stoves	20,723
Lloyd & Arms, Inc., Philadelphia, Pa.	Navy, S. & A.	Precision lathes	10,239
Giddings & Lewis Machine Tool Co., Fond du Lac, Wis.	War, Ordnance	Boring mill	24,240
Hanson-Whitney Machine Co., Hartford, Conn.	War, Ordnance	Milling machines	19,717
Austin-Hastings Co., Cambridge, Mass.	War, Ordnance	Engine lathes	23,154
Worthington Pump & Machinery Co., Harrison, N. J.	Navy, S. A.	Pumps, turbo-alternator.	211,483
Commercial Steel Castings Co., Marion, Ohio	War, Engineers	Pump parts	33,544
Lidgerwood Mfg., Elizabeth, N. J.	Navy, S. & A.	Steam winches	77,731
Consolidated Aircraft Corp., San Diego, Calif.	Navy, S. & A.	Airplanes, parts	4,699,057
Beech Aircraft Corp., Wichita, Kan.	War, Air Corps	Airplanes, parts	198,336
Adams & Westlake Co., Elkhart, Ind.	War, Air Corps	Lamp assemblies	22,570
Pump Engineering Service Corp., Cleveland, Ohio	War, Air Corps	Air pumps	24,156
Walter Kidde & Co., Bloomfield, N. J.	Navy, S. & A.	Steel cylinders	25,263
American Locomotive Co., Schenectady, N. Y.	War, Ordnance	Forgings	26,087
Western Pipe & Steel Co., San Francisco, Calif.	Interior	Steel pipe lines	28,965
West Virginia Rail Co., Huntington, W. Va.	War, Engineers	Reinforcing steel	60,116
Edge Moor Iron Works, Inc., Edge Moor, Del.	Navy, Yards & Docks	Boiler & accessories	176,522
Industrial Piping & Engineering Co., Baltimore, Md.	Navy, Yards & Docks	Boilers, fans	242,395
C. C. Moore & Co., San Francisco, Calif.	Navy, Yards & Docks	Boiler	169,023
Chicago Bridge & Iron Co., Philadelphia, Pa.	Navy	Storage tanks	135,760
General Machinery Corp., Hamilton, Ohio	Navy, Yards & Docks	Air compressor	43,515
Nordberg Mfg. Co., Milwaukee, Wis.	Navy, Yards & Docks	Air compressor	46,875
Cooper-Bessemer Corp., Mt. Vernon, Ohio	Navy, Yards & Docks	Air compressors	68,478
Elliott Co., Jeannette, Pa.	Navy, Yards & Docks	Turbo-alternators	434,635
Ingersoll-Rand Co., Washington, D. C.	Navy, Yards & Docks	Steam turbine	39,750
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.	Navy, Yards & Docks	Turbo-alternators	374,560
Brown & Sharpe Mfg. Co., Providence, R. I.	War, Ordnance	Milling machines	10,994
Wm. Sellers & Co., Philadelphia, Pa.	Navy, S. & A.	Boring mill	49,790
H. R. Krueger & Co., Detroit, Mich.	War, Ordnance	Machine tools	38,960
Cory & Joslin, Inc., San Francisco, Calif.	Navy, Yards & Docks	Pumping plant	153,000
Silent Hoist Winch & Crane Co., Brooklyn, N. Y.	Navy, Yards & Docks	Capstans	25,690
Victor R. Browning & Co., Willoughby, Ohio.	Navy, Yards & Docks	Crane	77,150
Orton Crane & Shovel Co., Chicago, Ill.	Navy, Yards & Docks	Locomotive cranes	178,410
R. W. Kaltenbach Corp., Bedford, Ohio.	Navy, Yards & Docks	Dry dock cranes	324,750
Star Iron & Steel Co., Tacoma, Wash.	Navy, Yards & Docks	Dry dock crane	154,700
Morgan Engineering Co., Alliance, Ohio	T. V. A.	Gantry carne	119,700
Winslow Marine Railway & Shipping Building Co., Seattle, Wash.	Navy, Yards & Docks	Caisson	389,650
C. H. Wheeler Mfg. Co., Philadelphia, Pa.	Navy, Yards & Docks	Condensers & equipment.	40,725

GOVERNMENT CONTRACTS FOR $19,000,000 WORTH OF PLANES

WASHINGTON—The War Department has awarded contracts for 571 airplanes, totaling nearly $20,000,000, under the $50,000,000 initial appropriation carried in the regular Army supply bill signed by the President. Five types of planes have been ordered:

Heavy four-motored bombers, similar to the "Flying Fortresses"—Consolidated Aircraft Corp., $2,880,000.

Single-motored "P-40" pursuit ships, —Curtiss-Wright Corp., $12,872,398

Twin-motored pursuit interceptors —Lockheed Aircraft Corp., $2,180,728.

Single-motored pursuit interceptors, —Bell Aircraft Corp., $1,073,445.

Photographic airplanes—Beech Aircraft Corp., $528,749.

The number of units in each order has not been revealed. Contracts do not include cost of engines, propellors, instruments or accessories. Balance of the $50,000,000 will be used to purchase these parts in quantity lots which will then be turned over to contractors for installation.

Louis Johnson, Assistant Secretary of War, announced that the next purchase would be from one or more of the four companies which built attack bombers for the Wright Field competition. The bomber order would amount to about $19,000,000.

The type P-40 pursuit ship is powered with Allison liquid-cooled engines, carries two machine guns and is credited with a speed of 400 m.p.h.

WATCHING WASHINGTON

McGraw-Hill Washington Bureau

PAUL WOOTON, CHIEF

Increased tension in Europe helps in speeding National Defense measures despite the usual legislative red tape. See small chance of ban on sale of munitions.

WASHINGTON—Last-minute glance at national defense:

War Department Expansion: 6,000 airplanes, signed April 3.

Regular Military Establishment: conference committee agreed, ready to report. Appropriates $510,000,000 including $50,000,000 for immediate start on airplanes.

Second Deficiency: $55,000,000 for ordnance and supplies; $36,000,000 to replace naval vessels; $6,378,000 for Langley field and new N.A.C.A. laboratory at Sunnyvale, passed Senate, now goes to conference.

Critical Raw Materials: $10,000,000 a year for four years for critical metals, passed Senate and reported in the House.

Navy expansion, authorizing expenditure of $66,000,000 for fifteen air bases, passed both Houses, goes now to conference.

Regular Navy Establishment: preliminary hearings going on.

Neutrality: Senate Foreign Relations hearings on several proposals; action this session almost certain.

Pilot training: House passed bill authorizing 15,000-student program to cost $5,675,000, but McCarran's bill in Senate, not yet reported, sticks to 20,000, at cost of $7,300,000.

Educational Orders: $32,500,000 authorized for next three years probably will be in the third deficiency clean-up bill at close of session. Likewise $250,000,000 balance for airplanes, and $24,000,000 for Panama.

Retooling Arsenals: there is $6,000,000 in the regular Army appropriation, requested by the President.

What Price Profit?

Seven or eight neutrality proposals, in hearings before the Senate Foreign Relations Committee, are simmering down to three principles: "cash and carry," "name the aggressor" and straight-out repeal. The first would let any belligerant come and get arms and supplies, lay cash on the barrel, and haul away. The second would embargo sales only to aggressors so designated by the President. Repeal would go back to old-fashioned international law. It is difficult to handle neutrality law, because our friends control the Atlantic and our enemy controls the Pacific. One thing looks certain: You will not be stopped from selling anything except possibly to Germany, Italy, and Japan.

Bigger and Better Merchant Marine

In 1936, when the direct subsidy shipping act was passed, the United States ranked sixth among maritime nations. Now, Lloyds' Register reveals that this country ranks second only to Britain in its construction program. During the first two years of the Maritime Commission it seemed doubtful if operators would be able to shift from their dirt-cheap war surplus basis to the high capital structure necessary for new boats. In fact that shift is still the main problem. But it is now evident that the President meant business when he said the government would get a merchant marine if he had to buy it. Whether outright federal ownership or closely-sponsored private management is in the offing, we appear to be on our way to a 100-ship new fleet by 1941; maybe 500 ships in 10 years as scheduled.

LEWIS LOSING?

John L. Lewis will be much weaker when and if the peace negotiations between the A.F.L. and C.I.O. are resumed. At least that is the confident prediction of Green and the A.F.L. crowd, who think that Lewis has hurt himself a lot in the present coal strike. Green's demand that the miners be polled was a masterpiece, they think. But this is only one of the projectiles they have loosed at the hated Lewis. For example, they are pouring out propaganda that Lewis has never done the miners any good—that his leadership has resulted in periodic stimulation of substitutes for soft coal, and that he failed to use his influence at the White House, when he was in a position to demand things, to prevent expansion of government-subsidized hydro-electric developments, which would deprive miners of employment.

Amendment of the Wagner Act is not sure, but it is at least possible which is was not just a few weeks ago unless Congress should go on and on through the summer. Latest development is the cockyness of the new majority of the House Rules Committee, under the leadership of Rep. Cox of Georgia, who has completely shorn Titular Chairman Sabath of his powers. The joke here is that the Administration fought so hard in the purge to beat John O'Connor so it would have Sabath running the Rules Committee. The Cox element, now in control, demands an investigation of N.L.R.B. unless the green light is given for the Wagner Act amendments.

This may even coerce the Senate, for everyone knows the Senate would approve the Walsh amendments (inspired by A.F.L.) if it could get to a vote, and the friends of the N.L.R.B. may permit a vote rather than have the House probing their pet organization.

"Miracle" Guns?

Shoot a hundred rounds or so from your guns and you've got to steam your battleship home for a rebore job. On Capitol Hill they're talking excitedly about a new alloy for gun linings that will stand up five times normal. The Navy has "no comment," which means to experienced observers that there is some basis for the story. How important, or what the Navy attitude is they don't know. The words "boron carbonite" have been mentioned.

Money for Overtime

If you're confused on wage-hour Administrator Andrews' rulings about time-and-a-half off in lieu of time-and-a-half pay for overtime, the last and correct ruling is that you have to pay money. Time off is no go. . . . Wage-hour amendments, including exemption of salaried workers earning $200 per month or more, will have been reported favorably to the House by the time you read this. All groups, except agricultural, are satisfied with the amendments as they stand, but there will be a drive to make changes from the floors of both houses. . . . Andrews tied up by injunction $2,500,000 worth of products (lumber) manufactured in violation of the law; owner forbidden to place goods in "commerce;" must sell them in intrastate.

Expect Patent Law Changes

Patent revision probably will be introduced this session but it's doubtful if there's time for action. O'Mahoney's T.N.E.C. committee's interim report is due as you read this. Most observers think it will recommend changes along the lines approved by Patent Commissioner Conway P. Coe in his testimony last winter. A 20-year limit protection period, patent court, and faster channels of litigation are expected. Individual congressmen interested in the subject, not T.N.E.C. as such, will offer the bills.

The fourth annual Machine Tool Electrification Forum, sponsored by Westinghouse at its East Pittsburgh plant April 18–20, was attended by about 100 representatives of machine tool manufacturers and dealers. Inspection trips through the plant were a part of the three-day forum

Fourth Annual Electrification Forum Draws Large Group to Westinghouse Plant

PITTSBURGH—Representatives of almost 50 machine tool builders met at the East Pittsburgh plant of the Westinghouse Electric & Mfg. Company, April 18-20, to discuss mutual machine tool electrification problems in a forum with Westinghouse engineers. Approximately 100 delegates were registered for the three-day conference.

One of the highlights of the forum was a talk by Wendell E. Whipp, president of the National Machine Tool Builders' Association and president of the Monarch Machine Tool Company. Mr. Whipp pointed out that "The national policy of increasing wage rates and shortening hours places upon industrial management the necessity of compensating for these increased costs by increasing the efficiency of the manufacturing organization. Better handling of materials, better methods, better cost control, and greater production per operator employed offer the only practical solution to this difficult problem. Anyone who has made even a partial survey of the manufacturing facilities in the metal-working industry must realize that obsolescence has been gaining during the past ten years. We must bear in mind the result of the *American Machinist* survey that indicates that over half of the machine tools in use in American industry today are obsolete and should be replaced."

He also pointed out that the N.M.T.B.A. has recently found it possible to undertake a study of the electrical problems that confront the machine tool builder. In regard to this problem, Mr. Whipp pointed out that "Those who have seen the preliminary reports of the committee on electrical problems realize how large a field this is, and how much need there is for study on the part of the machine tool builder of the possibilities of better methods of wiring up machine tools, better selection and better application of motors and control, and a better understanding of the materials that the electrical manufacturer already has to offer to his machine tool customers."

Welded fabrication as an aid to the electrification of machine tools was discussed at length by W. A. Maddox, welding supervisor, Cincinnati Milling Machine Company. Mr. Maddox brought out the need for careful process control and for the stress relieving of welded assemblies before machining. A formula for the selection of motors for custom-built machine tools was presented by W. S. Ridgway, development engineer, Ingersoll Milling Machine Company, in his talk during the second day of the Forum. Cost differences between different types of drive were discussed by R. S. Elberty, electrical engineer, Landis Tool Company.

A formula for selecting motors for machine tools was presented by W. S. Ridgway, development engineer, Ingersoll Milling Machine Company

The flexibility of modern electric drives for machine tools was described by G. E. Hieber, chief engineer of the Cincinnati Planer Company. In the old days, sheaves, belts, gears, shafts and other mechanical means were used to take off power from the main drive motor for all purposes. Besides costing more, the control of the separate element is more complicated mechanically than it is electrically. The following advantages were listed by Mr. Hieber as a direct result of the use of individual motor drives: (1) each spindle can be run independently, (2) each spindle can be run at its own speed, (3) either spindle can be run in either direction, (4) the spindles can be made to swivel, (5) the spindles can have independent speed ranges, and (6) the spindles cannot be overloaded, as each head is so designed that it will take the entire capacity of its individual drive motor.

Factors involved in the purchase of new machine tools were given in a paper presented by James R. Weaver of Westinghouse. He pointed out that frequently only 15-30 per cent of the total time a machine tool is in use is given over to actual cutting time. This, of course, is increased on automatic and semi-automatic machines applied to high-production operations. Even so, this percentage possibly could be increased by improvements in machine tool design. In this connection R. W. Owens, manager of the Westinghouse motor division, stated in his discussion of Mr. Weaver's paper that the ratio of actual cutting time to over-all time often is surprisingly low and can be used as a measure of the efficiency of the operation.

S.A.E. PERFECTS PLAN FOR WORLD AUTOMOTIVE CONGRESS

NEW YORK—An opportunity to visit both the New York and the San Francisco World's Fairs, as well as a chance to attend the Indianapolis 500-mile International Automobile Sweepstakes, will be available to the delegates attending the Society of Automotive Engineers World Engineering Congress beginning May 22.

Gathering from all parts of the world, engineers, production men, factory superintendents, and others concerned with automotive developments will convene in New York City for the international opening session. Presided over by R. R. Teetor, Perfect Circle Co., this session will feature an address by James D. Mooney, General Motors Corp., dealing with "Engineering, the Common Denominator of World Progress". Technical subjects developed at this meeting will be continued in the afternoon at a session presided over by J. C. Zeder, Chrysler Corp. One of the highlights of the New York meetings is scheduled to be an address by W. J. Cameron, Ford Motor Co.

Considerable attention will be devoted to developments in the aircraft industry, two days being devoted to this subject, the first presided over by Arthur Nutt, Wright Aeronautical Corp., with the second being headed by William Littlewood, American Airlines, Inc.

Problems involved in the design and manufacture of trucks, buses and rail cars will receive their share of attention. Colonel E. J. W. Ragsdale, Edward G. Budd Mfg. Co., will consider "Engineering Problems Involved in the Use of Ferrous Materials to Reduce Weight". Frank Jardine, Aluminum Co. of America, will discuss "Engineering Problems Involved in the Use of Non-Ferrous Materials to Reduce Weight". Col. G. A. Green, Yellow Truck & Coach Mfg. Co., will discuss several prospects of "Power Transmission for Buses."

The New York sessions will be climaxed by a banquet on Friday evening, May 26, at which Paul G. Hoffman, Studebaker Corp., will be toastmaster. This banquet will feature an address by C. F. Kettering, General Motors Corp., who will present his views on "The Engineer's Problems in the World of Tomorrow".

For the following two days the delegates will make their headquarters in the air-conditioned train at Indianapolis, Ind., using it as a base of operations for several inspection trips and attendance at the race.

The San Francisco meeting, from June 6-8, will feature transportation and maintenance sessions, recent developments in aircraft engine practice, and miscellaneous research findings concerning fuels and lubricants.

PERSONALS

CHARLES J. STILWELL

CLIFFORD S. STILWELL

CHARLES J. STILWELL, vice- president Warner & Swasey Co., Cleveland, Ohio, has been elected president, succeeding the late PHILIP E. BLISS. CLIFFORD S. STILWELL, vice-president, has been elected executive vice-president, while L. D. MCDONALD, assistant treasurer, has been named vice-president.

Charles Stilwell entered the Warner & Swasey Co. as a machine operator in 1910, following his graduation from Denison University. In 1911 he was transferred to the sales department and a year later was made district manager of the company's New York office. In 1914 he became European representative, and in 1919 was made export sales manager. He became general sales manager in 1922 and vice-president in 1929. In that year he was also named a director. In 1934 he served as president of the National Machine Tool Builders Association.

Clifford Stilwell, brother of Charles Stilwell, graduated from Denison University in 1912 and entered Warner & Swasey that year as a special apprentice. In 1913 he became a salesman in the company's Chicago territory, and the following year was made district manager of the Detroit office. He was made general sales manager in 1930, a director in 1934 and vice-president in 1935.

FRANCIS H. BROWNELL, chairman American Smelting & Refining Co., New York, N. Y., has been named chairman, General Cables Corp.

JOHN H. BRUINSMA has been elected president, Panyard Piston Ring Co., Muskegon, Mich., succeeding DONALD M. BIGGE, who will serve as vice-president.

A. G. BUSSMANN, wire sales department manager Wickwire-Spencer Steel Co., New York, N. Y., has been appointed sales manager of the company's Buffalo office.

N. J. CLARKE, vice-president in charge of sales Republic Steel Corp., has been elected a director.

SAMUEL P. CRAGO has been appointed assistant sales manager, Hamilton Standard Propellers Div., United Aircraft Corp., East Hartford, Conn., to succeed H. M. ELLIS.

GEORGE H. PRATT, for the past twelve years associated with the Hudson Motor Car Co., has been appointed general sales manager.

FRANK C. CONLON has been appointed sales engineer, Sheffler-Gross Co., Philadelphia, Pa.

H. M. ELLIS, formerly assistant sales manager Hamilton Standard Propellers Div., United Aircraft Corp., East Hartford, Conn., has become associated with the United Aircraft Service Corp., an affiliate, on the West Coast.

PERRY F. HADLOCK, for the past eleven years associated with the manufacture and design of General Electric radios, has been named manager of the G-E Radio sales division. Mr. Hadlock succeeds E. H. VOGEL, resigned, and will continue to make his headquarters in Bridgeport, Conn.

LAYTON F. HAWKINS has been appointed chief of the trade and industrial education service in the office of education, Department of the Interior.

W. WALLACE KELLETT, an official of Kellett Autogiro Corp., Philadelphia, Pa., has been elected president, Seversky Aircraft Corp. He succeeds ALEXANDER P. DE SEVERSKY, who will continue as director.

C. N. KIRKPATRICK, secretary Landis Machine Co., Waynesboro, Pa., has been elected a vice-president.

PIERRE L. MILES has been elected vice-president, Globe-American Corp., Kokomo, Indiana.

JOHN E. DIXON has been elected president, Lima Locomotive Works, Inc., succeeding SAMUEL G. ALLEN.

C. M. WHITE, vice-president in charge of operations Republic Steel Corp., has been elected a director.

F. G. SCHRANZ, manager of the Southwark Div., Baldwin-Southwark Corp., has been appointed general manager.

Mr. Schranz first became associated with the organization when he joined the Southwark Foundry & Machine Company in 1915. It was largely due to his efforts that the manufacture of hydraulic machinery and special equipment was commenced. Mr. Schranz later served as vice-president in charge of sales and engineering, as a director of Southwark Foundry & Machine, and subsequently as sales manager and manager for the Southwark Division after Southwark had been acquired by the Baldwin Locomotive Works in 1929.

CHARLES L. RICE, vice-president of the Western Electric Co. and manager of its Hawthorne works in Chicago, has been elected a director.

WILLIAM A. SCHEUCH, works manager Nassau Smelting & Refining Co., a subsidiary of the Western Electric Co., has been elected a vice-president.

PAUL SMITH, production manager Warner Electric Brakes Mfg. Co., Beloit, Wis., has been appointed general manager.

WILLARD T. WALKER, president Walker Mfg. Co., Racine, Wis., has been elected chairman. JAMES S. ALLAN succeeds him as president.

R. J. KNERR, Lehigh Mills superintendent of maintenance, Bethlehem Steel Co., has been appointed general superintendent. He succeeds ARTHUR C. CUSICK, who has been appointed general superintendent, Crucible Steel Co. of America.

B. W. DREYER has been appointed district manager of Steel & Tubes, Inc., Los Angeles, Calif., a subsidiary of Republic Steel Corp., Cleveland, Ohio.

C. GRINDROD, former sales engineer Union Drawn Steel Co., Massillon, Ohio, has been appointed factory manager, J. J. Tourek Mfg. Co., Chicago, Ill., screw machine products manufacturer.

F. G. SCHRANZ

M. A. MILLER

R. G. PLUMLEY

RICHARD G. PLUMLEY, works manager of the Stamford Div., Yale & Towne Mfg. Co., has been appointed general manager. MARK A. MILLER, previously associated with the sales department, has been named assistant general manager.

WALTER F. MUNFORD, Cuyahoga works superintendent, American Steel & Wire Co., has been appointed assistant to the vice-president in charge of operations. H. L. JENTER, formerly assistant superintendent at Cuyahoga, has been named general superintendent. J. D. BASTER has been appointed superintendent of the cold rolled mills; A. G. MONTGOMERY, superintendent of the hot mills, and V. H. LEICHLITER, superintendent of the wire mill.

MAX L. WATERMAN, former works superintendent Singer Mfg. Co., Bridgeport, Conn., has been named assistant vice-president.

HENRY JUDE has been appointed general sales manager of the locomotive equipment division, Manning, Maxwell & Moore, Inc., Bridgeport, Conn. He succeeds C. H. BUTTERFIELD, who has recently made vice-president in charge of sales of the industrial and locomotive division.

CYRIL GRINDROD

HENRY JUDE

BUSINESS ITEMS

Borg-Warner Corp., Chicago, Ill., has purchased the Pump Engineering Service Corp., Cleveland, Ohio, airplane parts manufacturer.

J. G. Brill Co. and the Mack Mfg. Corp. have received a $750,000 order for 55 trolley buses to be placed in service by the Delaware Electric Co., of Wilmington, Del. Electrical equipment for the majority of buses, which constitutes one of the largest single orders on record, will be furnished by the General Electric Co.

Howard Aircraft Corp., Chicago, Ill., is planning a $2,000,000 factory with an annual capacity of approximately 350 planes. The building will cost about $150,000 and the equipment $50,000. Present employment of 75 is eventually expected to reach 750. In addition to its transport planes, the company is planning a "flying box car" for carrying freight.

Hydro-Power Systems, Inc., Mount Gilead, Ohio, has been organized for the manufacture and further development of hydraulic machine drives and their component parts.

International Harvester Co., Chicago, Ill., is planning to move its cream separator manufacturing division, now located at the company's Milwaukee works, to Richmond, Ind. The move is required to permit enlargement of the diesel engine and tractor manufacturing division.

L. J. Kaufman Mfg. Co., Manitowoc, Wis., has purchased the Gaterman line of tapping machines from the W. Gaterman Mfg. Co., also of

Lockheed Aircraft Corp., Los Angeles, Calif., is planning the introduction of two new giant transport ships. The planes will be manufactured by procedure similar to that being used by the company in the mass production of British bombers.

Northrop Div., Douglas Aircraft Co., El Segundo, Calif., is erecting an addition to its factory at a cost of $50,000.

Park Sales Co., New York, N. Y., has introduced a line of precision instruments made by P. Roch of Switzerland. Included are stainless steel vernier calipers, depth and height gages, protractors, etc.

R.C.A. Mfg. Co. is planning to install machinery for the manufacture of sound equipment in a new addition just started to its Indianapolis plant.

Reliance Steel Products Co., Los Angeles, Calif., southern California representative of the Pacific States Steel Corp., has established a reinforcing steel and wire mesh fabrication and distribution plant in Los Angeles.

The Rock Island and Pacific Railroad is planning to spend approximately $1,250,000 for streamlined diesel trains to be operated between Chicago and Denver.

Ryan Aeronautical Co., San Diego, Calif., is erecting a new storage and hangar costing approximately $100,000.

Joseph T. Ryerson & Son, Inc., Chicago, Ill., has modernized its Boston plant and added over 30 per cent to its storage facilities.

Stearns Magnetic Mfg. Co., Milwaukee, Wis., has appointed VERNON WHITING, Dallas, Texas, as its representative.

The Trane Co., La Crosse, Wis., has broken ground for this year's second addition to its plant, as a result of increased business volume.

United Engineering & Foundry Co., Youngstown, Ohio, is planning to move its Worcester, Ohio, machine shop to Japan, according to GEORGE T. LADD, president. Mr. Ladd stated that the plant was not being sold to the Japanese, but was simply being moved to a location where it could be "used to better advantage."

Vascoloy-Ramet Corp., North Chicago, Ill., has put into operation a plant in Jersey City, N. J., for the manufacture of tantalum carbide wire, tube, sectional and shape dies, cutting tools and blanks. Operations are under the direction of JOHN KONTRA, JOSEPH HALL and JOHN ADLER, who were formerly associated with the Union Wire Die Company.

Ward Leonard Electric Co., Mt. Vernon, N. Y., has announced that its Philadelphia office has been moved to Room 329, 1600 Arch St. FRANK BEEDE, formerly of the Chicago office, is district manager.

Western Engine Corp., Los Angeles, Calif., has been acquired by the Vernon Tool Co., Ltd., of that city.

OBITUARIES

JOHN G. OLIVER

JOHN G. OLIVER, chairman of the board of Bardons & Oliver, Inc., Cleveland, Ohio, tool manufacturer, died April 15 at his home in that city. He was 77 years of age.

At the time of his death Mr. Oliver was also president of Joseph Dyson & Sons, Inc., forging manufacturer. He first came to Cleveland in 1882 and joined the Warner & Swasey Co., which had been founded two years previously. Nine years later he and GEORGE C. BARDONS, a superintendent at Warner & Swasey, organized Bardons & Oliver.

Mr. Oliver had served as president of the company until last January, when he was named chairman of the board.

FRANK F. BEALL, president and treasurer of the Saylor-Beall Mfg. Co., died April 6. He was internationally known for research in heat-treating and metallurgy. In 1907 Mr. Beall became factory superintendent of the Packard Motor Car Co., and was vice-president in charge of production when he left the company fifteen years ago. He was an organizer of the Gray Motor Co., and at one time vice-president of Continental Motors Corp.

WALTER BROMLEY, assistant sales manager American Screw Co., Providence, R. I., died recently.

DAVID M. CASTERLINE, 40, manager of the experimental department of the S. F. Bowser & Co., Fort Wayne, Ind., pump manufacturer, died recently.

WALTER J. FRIEDLANDER, president Aeronautical Corp. of America, light plane manufacturer, died April 19 at his home in Cincinnati. He was 64 years of age.

ALLSTON SARGENT, president Sargent Metal Window Corp., a subsidiary of American Radiator & Standard Sanitary Corp., New York, N. Y., died following a two weeks illness. He was 62 years of age.

LEOPOLD KATZ, president Elkay Mfg. Co., Chicago, Ill., plumbing supply manufacturer, died April 8 at his home in that city. He was 70 years of age.

ARTHUR C. SWALLOW, SR., chairman Motor Castings Co., Chicago, Ill., died April 11 at his home in that city following a two years illness. He was 68 years of age.

LOUIS A. WITRY, 69, former vice-president and engineer for the John Deere Tractor Co., died April 18 at his home in Waterloo, Iowa.

MEETINGS

AMERICAN ELECTRO-PLATERS' SOCIETY. International convention, Asbury Park, N. J., June 19–22. W. J. R. KENNEDY, executive secretary, 90 Maynard St., Springfield, Mass.

AMERICAN GEAR MANUFACTURERS ASSOCIATION. Annual meeting, Hotel Cavalier, Virginia Beach, Va., May 15–17. J. C. MCQUISTON, secretary, 602 Shields Bldg., Wilkinsburg, Pa.

AMERICAN IRON AND STEEL INSTITUTE. General meeting, Hotel Waldorf-Astoria, New York, N. Y., May 25. Executive secretary, WALTER S. TOWER, 350 Fifth Ave., New York, N. Y.

AMERICAN SOCIETY OF MECHANICAL ENGINEERS. Semi-annual meeting, San Francisco, Calif., July 10–14.

AMERICAN SOCIETY FOR TESTING MATERIALS. Annual meeting and exhibit of apparatus and instruments, Chalfonte-Haddon Hall, Atlantic City, N. J., June 26–30. R. E. HESS, assistant secretary, 260 S. Broad St., Philadelphia, Pa.

ASSOCIATED MACHINE TOOL DEALERS OF AMERICA. Spring convention, Van Curler Hotel, Schenectady, N. Y., June 5 and 6. THOMAS A. FERNLEY, JR., executive secretary, 505 Arch St., Philadelphia, Pa.

NATIONAL METAL TRADES ASSOCIATION. Annual convention, Palmer House, Chicago, Ill., May 24–25. O. R. ABBOTT, office manager, 122 S. Michigan Ave., Chicago, Ill.

SOCIETY OF AUTOMOTIVE ENGINEERS. World automotive engineering congress, Hotel Pennsylvania, New York, N. Y., May 22–28; Hotel Statler, Detroit, Mich., May 31–June 8; Hotel Fairmont, San Francisco, Calif., June 6–8.

STEVENS ENGINEERING CAMP. Ninth annual economics conference of engineers, Johnsonburg, N. J., June 24–July 3. JAMES CREESE, vice-president, Stevens Institute of Technology, Hoboken, N. J.

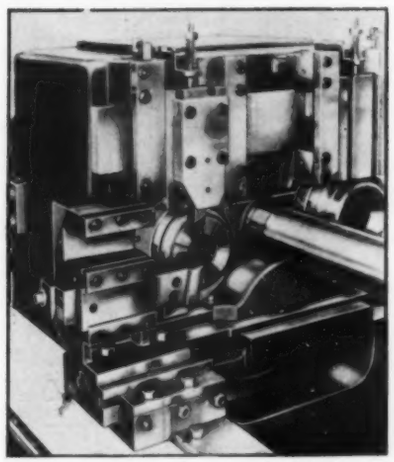
SHOP EQUIPMENT NEWS

"Di-Matic" Bar Stock Machines Have Non-Indexing Spindles

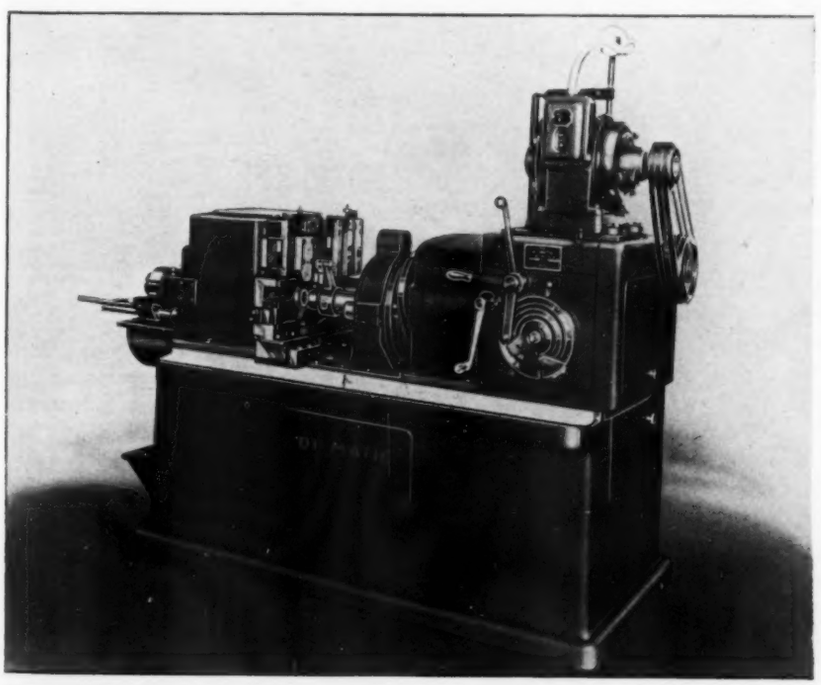
Available in two standard models, the "Di-Matic" two-spindle bar stock automatics developed by the Windsor Di-Matic Div., the Billings & Spencer Co., Hartford, Conn., feature standard design non-indexing spindles set in a heavy frame with opposed adjustable tapered roller bearings at the front and cylindrical roller bearings at the rear. In the Model A machine, which is made only in one size with capacity for 1½ in. diameter round stock, it is possible to machine any work requiring a form tool, cut-off tool or any combination of turret tools that can be accommodated in two end tool positions.

The cross slide of this machine carries a form tool for each spindle and is operated by a direct-acting cam revolving between two rolls to provide smooth direct action without backlash. The independent cut-off slide is mounted above the spindle and is independent of the other tools. A cylindrical drum, carried in a heavy housing that slides on the bed of the machine on hardened and ground steel ways, constitutes the turret of this machine. It has two tool stations. Operation of the turret is directly from the cams on the drum above the slide. For ordinary work, the cams are universal. On special work they are accessible and easy to change.

Similar in design to the Model A machine, the Model B "Di-Matic" has a simple tool slide in place of the indexing tool slide. This slide carries two end tool positions which are not indexed. The chucking and stock feed drum on this machine is doubled cammed to feed out through both spindles simultaneously against a double stock stop. The forming slide is double tooled and has a forming tool holder on each side of each spindle. The cut-off slide is arranged to cut-off both pieces at once. This machine is made in two sizes, with maximum capacities of 1½ and 2⅝ in. diameter round stock. Both models are driven through a constant-speed pulley and pick-off type change gears to provide speeds up to 1,800 r.p.m.



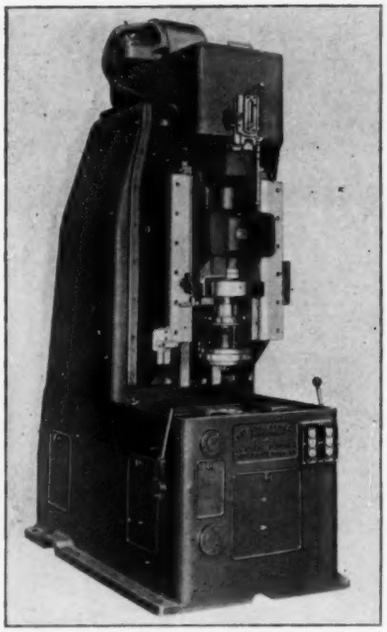
Arrangement of the cross slide and cut-off slides of the Model A machine is shown. During the indexing of the turret, the cross slides are centered



The Model A "Di-Matic" two spindle automatic is shown here in the index position. Base is cast in one piece and there is ample room for chips

Model VT Tapper Uses Floating Taps

The vertical Model VT boring and threading machine developed by The National Acme Co., 170 E. 131st St., Cleveland, Ohio, was designed especially for precision threading or finish-boring of couplings to A.P.I. standards for high pressure work in the oil industry. Available in three maximum chuck capacities for 4½, 8⅝, and 13⅜ in. diameter A.P.I. couplings, this hydraulically and mechanically operated machine features a work-holding chuck mounted in an indexing plate which is held rigidly while the tap is floated vertically into the work. After one end of the coupling has been threaded, the chuck is indexed 180 deg. and the cutting operation is repeated on



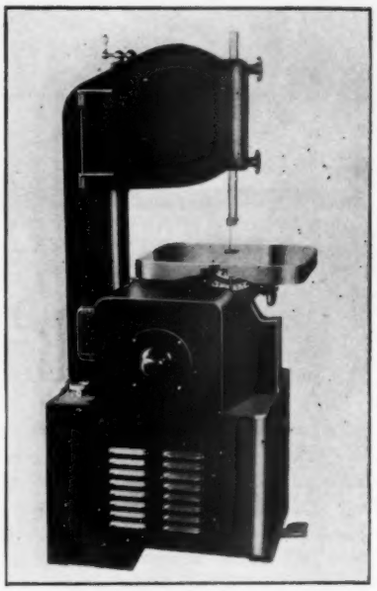
the opposite end of the coupling. Since the chuck jaws are not released from the work between opposed tapping operations, both ends of the coupling are held in alignment. The rapid chuck indexing movement is by hydraulic motor to an automatically controlled lock bolt which is positively seated without shock. Style RES-L "Namco" positive acting collapsing taps are provided on these machines. When the machine is used for rough boring, the lead screw mechanism is replaced by an adjustable hydraulic valve control.

Improved Bench Lathe Offered by South Bend

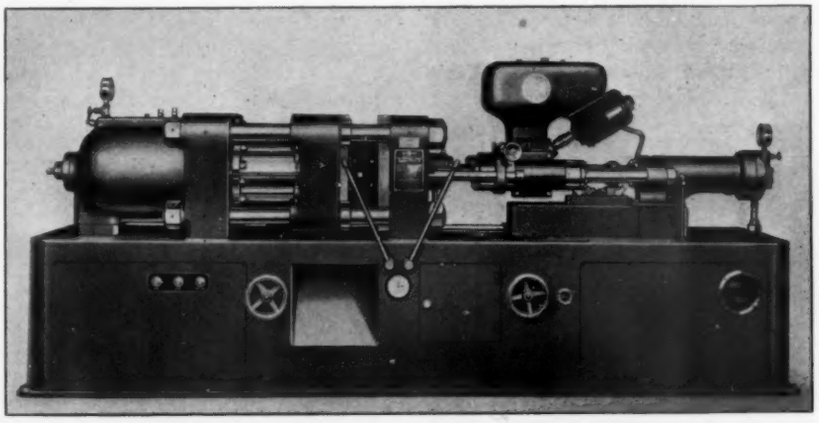
Two improved models have been added to the line of 9-in. "Workshop" precision bench lathes, manufactured by the South Bend Lathe Works, 426 E. Madison St., South Bend, Ind. The Model A lathe is of the quick change gear type and has an automatic apron with friction clutch drive for operating the power cross feeds and power longitudinal feeds. The Model B lathe is of the standard change gear type and also has an automatic apron with friction clutch drive. The quick change gear box developed for the Model A lathe provides 48 changes for cutting right- and left-hand screw threads ranging from 4 to 224 per inch, and 32 power longitudinal feeds ranging from 0.0014 to 0.0208 in. per rev. of the lathe spindle. An automatic safety interlock prevents engaging the power carriage feeds while the half-nuts are in use for cutting screw threads.

Type OS-14 Band Saw Has 14-In. Throat

Designed for sawing out medium and small sized dies, punches, stripper plates and miscellaneous parts, the Type OS-14 open-end band saw placed on the market by Grob Bros., Grafton, Wis., accommodates saw blades $\frac{1}{16}$, $\frac{3}{32}$ and $\frac{1}{8}$ in. wide. Saw blades 150 ft. long are wound helically on a drum which has a threaded groove. A multiple-speed motor provides the forward or cutting speeds, and a second motor reverses the band at high speed. Only 10 sec. are required to reverse the band, while at the slow forward speed cutting time is $2\frac{1}{2}$ min. The 20x20-in. table tilts four ways. Depth of throat is 14 in., and the distance from the floor to the top of the table is 40 in. Net weight, 1,000 lb.



Improved Molding Presses Offered by H.P.M.



The Model 200-H-7 and the Model 200-H-9 injection molding presses have been developed by the Hydraulic Press Mfg. Co., Mount Gilead, Ohio, to meet a demand for injection molding presses of 7 and 9 oz. per shot capacities. These presses are entirely self-contained, and are of the horizontal clamp type. Molds may be changed quickly and it is claimed that no fine adjustments are required in changing over from one job to another. Hence, these presses are suitable for either large or small production runs.

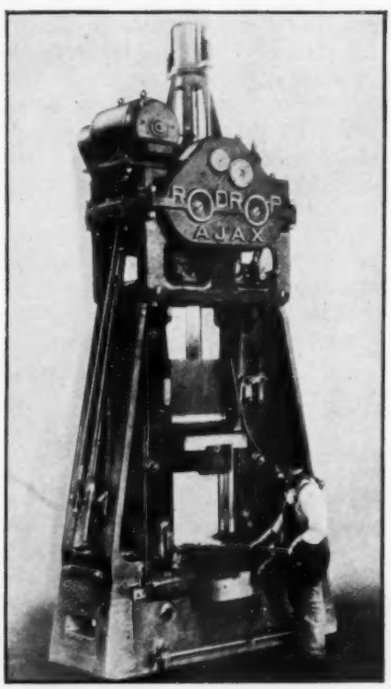
The power unit is mounted in the base of the press, on top of a reservoir which contains the operating oil. This unit consists of a 15-hp. motor connected through flexible couplings to two high-pressure radial pumps operating at 2,000 and 2,500 lb. per sq. in. respectively. The first pump operates the injection cylinder, and the second operates the clamp system.

The clamping system has an internal booster ram with a recently designed shift-over from the booster ram to the main ram. Clamp platens are equipped with steel bolster plates. The clamp itself is double acting. Two adjustable ejector pins are arranged to actuate the ejector in the mold on the return stroke. The in-

jection chamber is mounted on the feed cylinder which, in turn, is mounted on a steel cradle held in alignment on two tie rods. The material is heated indirectly with electricity through a circulating fluid medium.

The material hopper has 50 lb. capacity, and material is forced through passages by means of a feed screw driven by an electric motor. Feed is regulated automatically. Both presses are equipped with manual, semi-automatic or full-automatic control. Clamping pressure of 200 tons, with maximum projected area of mold cavity of 50-100 sq. in. are provided on both presses. Maximum mold size is 16½ x 24 in. and minimum shut height of mold is 6 in. Maximum opening between platens with the press in the open position is 18 in. Maximum stroke of mold carrier platen is 12 in. Plasticizing capacities are approximately 40 lb. per hr. for the Model 200-H-7 press, and 50 lb. per hr. for the Model 200-H-9 machine.

Ajax "Rodrop" Forging Hammer Uses Lift Rod

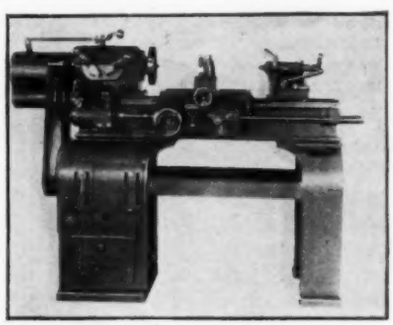


Instead of using boards for lifting the ram, a heavy square steel lift-rod, taper-fitted in the ram and installed on the diagonal, is incorporated in the "Rodrop" forging hammer developed by the Ajax Mfg. Co., 3830 Lakeside Ave., Cleveland, Ohio. Friction rolls lift the rod and have a long life in comparison with boards. This hammer approaches steam hammer operation, as the stroke of the ram may be varied at will by the operator.

Because of their transverse mounting the friction rolls are of large diameter without overhanging the head frame and, in consequence, have a wide arc of contact with the rod. The rolls are brought into and out of contact with the lift rod by rocking the eccentric hubs in which their shafts are carried, by means of a small-diameter air cylinder. A differential valve on the air line of this cylinder, governed by the amount the operator depresses the treadle, controls the height to which the ram is raised before it is released. This makes it possible to strike blows of varying force. On full stroke the top of the lift rod is acted upon by an accelerator air cylinder which gives the ram a quick acceleration so that heavier blows are struck in quicker succession than if acted upon by gravity alone. The hammers are available in a full range of standard sizes from 1,500 to 6,500 lb. and larger. When compressed air is not available the hammer is equipped with an incline-operated roll release lever.

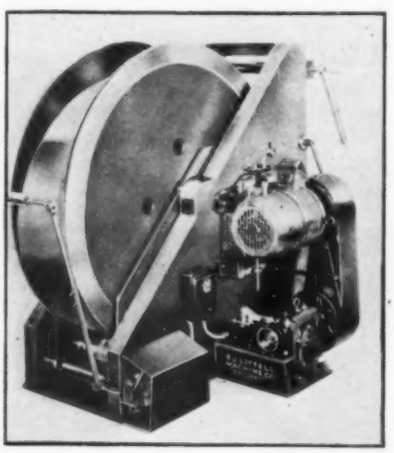
New Sebastian Lathe Provides Eight Speeds

Eight speeds ranging from 80 to 2,000 r.p.m. are available in the 12-in. Type EV high-speed lathe announced by The Sebastian Lathe Co., Cincinnati, Ohio. The precision geared head is equipped with Timken roller bearings throughout and shaved gears assure quite operation. Feeds of 0.010, 0.020, 0.040, and 0.080 are provided. The 2 hp. drive motor is mounted in the cabinet bed and drives the geared head through V-belts. Specifications: Distance between centers, with a 3 ft. bed, 11 in.; with a 5 ft. bed, 35 in.; hole in spindle $1\frac{5}{16}$ in.; collet capacity, $\frac{7}{8}$ in. with lever draw chuck and $1\frac{5}{16}$ in. with nose-type draw chuck; shipping weight, with a 3 ft. bed, 1,375 lb.



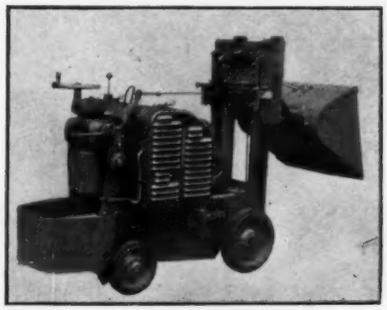
Coil Cradle Reel Handles 1½-Ton Coils

An improved coil cradle reel, in which the coil is supported by knurled rollers mounted on two parallel shafts running in self-aligning roller bearings, has been announced by the F. J. Littell Machine Co., 4125 Ravenswood Ave., Chicago, Ill. This reel will handle coils that weight up to 3,000 lb., and measure from 1 to 8 in. wide. It is driven by a 2 hp. motor through a 3 to 1 variable speed drive and worm reducer. To obviate excessive overrun when handling coils of considerable inertia, the reel is equipped with a magnetic brake which is applied when the loop, formed during unwinding, trips a limit switch located at the rear end of the cradle.



New Scoop Truck Handles Bulk Materials

The Baker Industrial Truck Div., Baker-Rauling Co., 2168 W. 25th St., Cleveland, Ohio, offers the Type JK-20 scoop truck for rapid handling of bulk materials up to 1,000 lb. capacity. The scoop is filled by driving the truck into a pile of the material and then raising it by means of a cable winch. After tipping the bucket to release his load, the operator may quickly restore the scoop to floor level by pulling a lever which permits the carriage to drop by gravity. The resulting blow is



cushioned by means of an air-check. The truck is a two-wheel drive, two-wheel steer model and is fitted with a "No-Plug" controller.

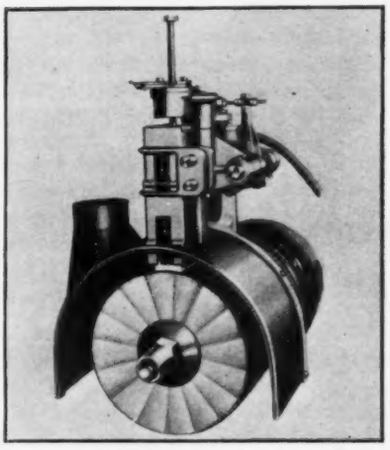
"Magnilite" Combines Light and Magnifier

Mizzy, Inc., 105 E. 16th St., New York, N. Y., has combined a lighting unit and magnifying glass in the "Magnilite" stand for inspectors and tool and die makers. It is detachable from the stand, and can be used in

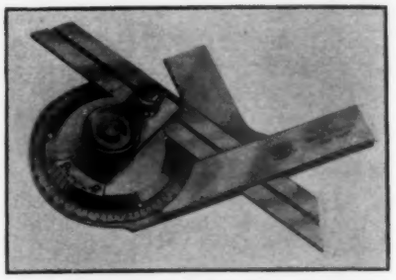
any position. The light unit concentrates illumination on the object being inspected which, in turn, is viewed under magnification from above. The unit is attached to the base on a universal joint and permits adjustment to any desired position.

"Auto-Doper" Applies Buffing Composition

Applicable to buffing lathes, and semi-automatic and automatic buffing equipment, the "Auto-Doper" applies buffing composition to the wheel automatically. The head oscillates so that the bar composition is applied to the wheel momentarily and, as the composition is "on and off" the wheel, the force of air generated by the revolving wheel keeps the composition cool. When applied to buffing machines having conveyors, the "Auto-Doper" is operated by compressed air through a three-way valve, timed to the conveyor. On machines without a conveyor unit, particularly semi-automatics



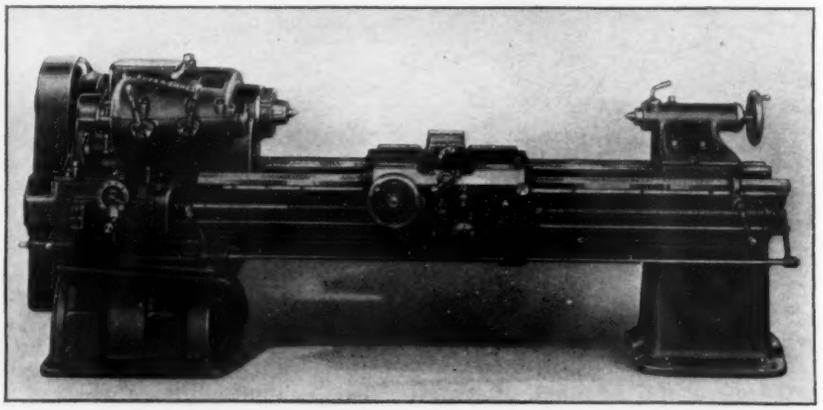
and polishing lathes, the timing of the application can be arranged for by an electric timing device or by a foot operated valve. The standard unit, as shown, will handle bars from 2-in. square up to 2x6 in.



"Mauser" Protractor Is Accurate to 5-Min.

The George Scherr Co., 128 Lafayette St., New York, N. Y., is distributing an improved "Mauser" universal bevel protractor which is claimed to be accurate to 5 min. of arc, or 1/12 deg. The dial is graduated in degrees for the full circle and a vernier is provided. The tool may be obtained fitted with either 6, 8 or 12 in. blades, which are beveled at each end to 45 and 60 deg., respectively. The back of the tool is finished flat so that it may be flush when laid on work or paper. The dial may be clamped rigidly by a thumb nut and the blade may be clamped independently of the dial.

Model C Lathe Has Twelve Speeds



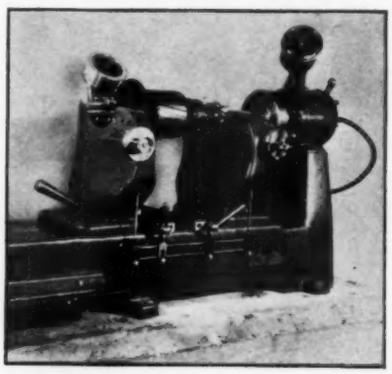
The 20-in. Model C geared head lathe offered by the Boye & Emmes Machine Tool Co., Cincinnati, Ohio, provides twelve spindle speeds, with a standard range of from 12½ to 436 r.p.m. Speed changes are made through positive jaw tooth clutches which slide on splined shafts. Gears are made from individually hammered forgings and have lapped teeth. Headstock gears are splash and cascade lubricated. Motor is mounted on a hinged plate in the head end cabinet leg. Drive to the headstock may be by V-belt, flat belt or silent chain. Driving pulley is mounted on anti-friction bearings and driving clutch is of the multiple-disk drive plate type.

Providing 48 feed and thread changes, the gear box is entirely inclosed. Odd threads or course leads not contained in the regular range of 1 to 56 threads can be obtained by mounting two gears on a quadrant. Apron journals, bed ways, carriage cross slides and the cross feed screw journal are lubricated automatically by a pump in the apron. This pump is actuated by a pinion meshed with

the bed rack. Start and stop levers for operating the main drive clutch are located directly under the head. Also a lever for controlling the main clutch is attached to and travels with the apron. Distance between centers on this lathe, with a 10 ft., bed is 72 in. and domestic shipping weight is 8,500 lb.

"Equipoise" Balancers Made in Wide Range

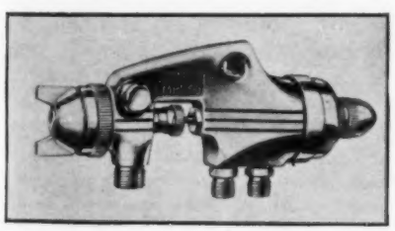
The Globe Tool & Engineering Co., Dayton, Ohio, has announced the improved "Neon Equipoise" dynamic balancer, in which the equipoise feature is an addition to the neon balancer offered in the past. The new unit is claimed to completely neu-



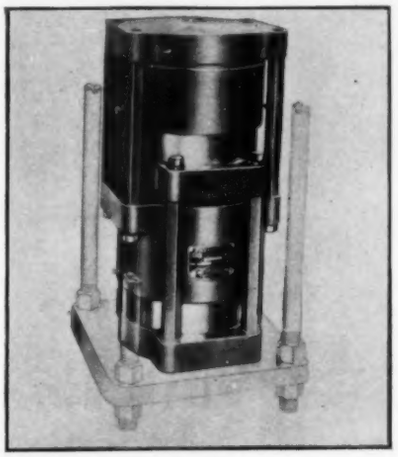
tralize any unbalance in any plane selected by the operator and to give an accurate reading as to angle and amount of unbalance in the other plane. The equipoise feature can be added to any of the older Series N balancers. The machine illustrated is the No. NE-1 balancer and will take work from 1 to 25 lb. It has a swing up to 15 in.

Streamlined Spray Gun Has Automatic Action

The "Thor" Model 21 streamlined automatic spray gun announced by Binks Mfg. Co., 3114–26 Carroll Ave., Chicago, Ill., is designed for use in connection with an improved three-way valve for cam, hand or foot operation of the air plunger.

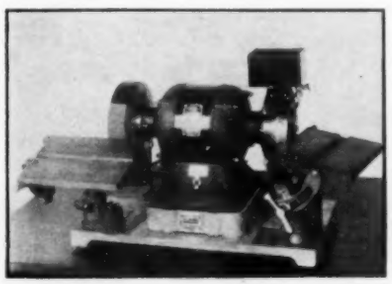


This automatically operates the trigger of the gun. The gun is available in set-ups for all modern finishing materials, including lacquer, synthetic enamels and ceramic or vitreous materials.



Model C Die Cushion Made in Five Sizes

Model C pneumatic die cushions developed by Dayton Rogers Mfg. Co., 2830 S. 13th Ave., Minneapolis, Minn., are designed primarily for use on power drawn presses where tandem die cushioning means are necessary. Use of these cushions makes it possible to double or triple the ring holding pressure when the press bed opening is limited. Made in five sizes, these cushions have a piston diameter of 10 to 18 in. and can be furnished in single, double or triple units with press mountings as shown.



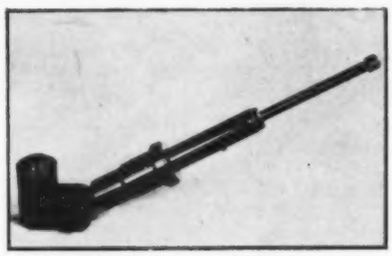
Flexible Tool Grinder Offered by T. C. M.

Developed especially for grinding and polishing single-point turning and boring tools, the "All-In-One" tool grinder announced by T.C.M. Mfg. Co., First and Sussex Sts., Harrison, N. J., has two tilting tables, each of which will tilt up to 40 deg. The tables can be moved to any position around the wheel, so that grinding can be done on the face of a cupped wheel as well as on the periphery. Tables have an up and down adjustment, which permit the grinding of a tool edge on the center line of the wheel.

Equally suitable for grinding high-speed steel, Stellite and carbide tipped tools, this grinder uses 6-in. diameter wheels and so holds the maximum grinding speed to less than 2,700 ft. per min. This is claimed to prevent undue heating without fear of burning or checking the tip.

Small Hydraulic Jack Has 50-Ton Capacity

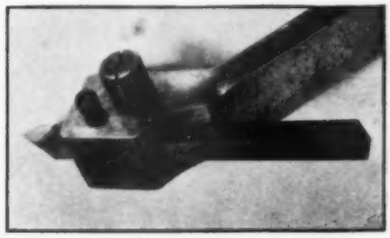
Weighing only 46 lb., this small 50-ton capacity hydraulic jack offered by the Rochester Machine Co., 151 Virginia Ave., Rochester, Pa., is designed for use in locations too small to admit a standard jack. This jack is made of steel throughout and has an over-all height of 6 in. and a lift of 2¾ in. Minimum space re-



quired for the lifting cylinder is 5x6½ in. In operation, it is necessary only to place the lifting cylinder under the object and screw in the long barrel until the plunger contacts the object. Then the long screw is turned to lift the object.

"Elk" Toolholder Has Many Uses

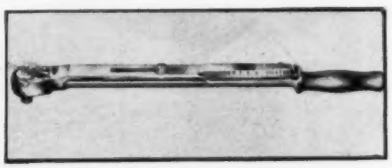
Designed to hold the bit in practically any position required for facing, turning, boring, threading or cutting-off operations, the "Universal" tool holder developed by Elk Machine Tool Works, 33 W. 60th St., New



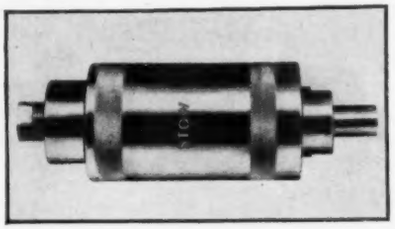
York, N. Y., has two tool bit openings at right angle to each other. The holder shown is broached to take $\frac{3}{8}$ in. square bits. Round bits also can be used, and it is possible to use either round or square $\frac{5}{16}$ in. bits by employing shims.

"Measurrench" Shows Right-Hand Torque

J. H. Williams & Co., 225 Lafayette St., New York, N. Y., is offering the No. S-57 torque "Measurrench" for indicating right-hand torque when tightening nuts and bolts. This reversible ratchet-type wrench may be used



as follows: (1) By sight reading—the calibrated scale shows applied pressures of 20 to 200 ft. lb. and is read at the point where the index shoulder crosses the scale, or (2) by sound reading, as a sharp sound signal is given for any desired torque from 35 to 200 ft. lb. by setting the sound device. The 36-tooth ratchet wheel, with a double-tooth pawl, makes possible a short operating swing of only 1/30 full turn.



New Handpiece Has Reciprocating Action

A reciprocating handpiece for use on flexible shaft power drives in die making and metal pattern shops has been announced by Stow Mfg. Co., Binghamton, N. Y. This handpiece converts the rotary motion of the flexible shaft into a reciprocating action. Files and saw blades having a $\frac{1}{4}$-in. shank can be inserted in this handpiece. Reciprocating motion has a 1-in. stroke. The handpiece is interchangeable in the same size range with other flexible shaft attachments and is designed for use at speeds not exceeding 1,000 r.p.m.

Centrifugal Enameler Uses Removable Basket

Smooth, even coatings of enamel, lacquer, japan or rust preventing agents are secured rapidly in the centrifugal enameler announced by Tolhurst Centrifugal Div., American Machine and Metals, Inc., 100 Sixth Ave., New York, N. Y. Excess coating material is completely recovered for re-use. Hollow or cupped articles can be handled readily without filling or clogging. The machine itself consists essentially of a removable basket, and a curb. Thickness of coating can be controlled easily. Four standard sizes, ranging in capacity from 1 to 15 cu. ft. of parts per load are available.

Type SA-150 Welder Has Dual Control

Self-indicating dual continuous current control is provided on the Type SA-150 motor-generator type arc welder developed by the Lincoln Electric Co., 12818 Coit Road, Cleveland, Ohio. Both job selector and current control are calibrated and equipped with dials which indicate the type of work and number of amperes for each setting. At the lower part of its range, this welder delivers a current of light-penetration characteristics for the welding of extremely light-gage material. At the upper portion of its range it delivers ample current for the speedy welding of heavier materials. Current range is 45–200 amp. and the welder can be used with either bare or shielded arc type electrodes.

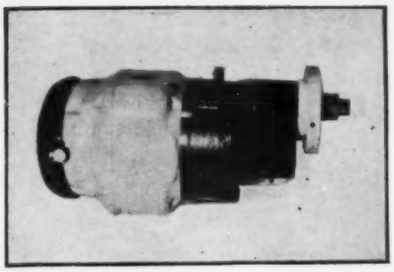
"Rollaway" Jack Has Rubber Tires

Used in connection with "Re-Nu Top" skid platforms recently developed, the "Rollaway" jack offered by the Yale & Towne Mfg. Co., 4530

Tacony St., Philadelphia, Pa., provides mechanical materials handling facilities for even the smallest plant. The jack is streamlined and mounted on rubber-tired wheels which revolve on Hyatt roller bearings. A narrow wheel tread is used in order to reduce the tendency of handle whip. An equalizing spring inclosed inside the tube of the handle forces the handle upright when the platform is elevated, preventing the handle from falling on the ground.

Precision Motors Have Geared Heads

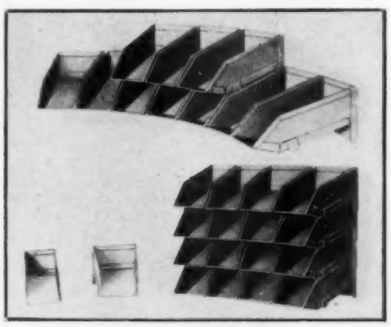
A line of geared head precision electric motors has been placed on the market by the Portman Machine Co., 2236A Bathgate Ave., New York, N. Y. These motors are designed for industrial applications where a compact motor and spindle head in one unit assembly can be used to advantage as a direct power drive. The spindle unit features an off-set shaft



in a gear housing which incorporates integrally built-in seals to protect the assembly against all foreign matter. These motors are available in ratings from 1–5 hp. and with standard spindle speeds of 1,150, 1,725, 2,300, 3,450 and 5,600 r.p.m. Spindle nose ends of various types are available.

Assembly Bins Have Sloping Floor

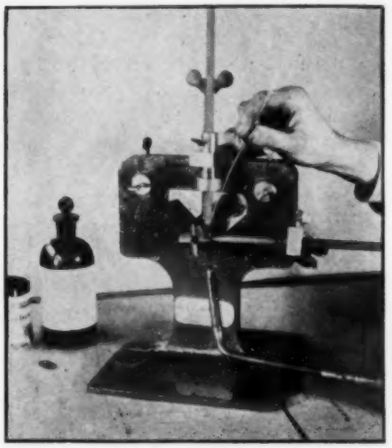
The Stackbin Corp., 42 Troy St., Providence, R. I., has developed a uniform stacking assembly bin which keeps parts always within finger-tip reach. Made with a sloping floor which keeps the contents towards the front, the bins can be set up in a semi-circle and can be stacked one above the other to keep all parts



within the most efficient reaching distance. These bins are 8 in. long, 2½ in. deep, 4 in. wide in the back, and 3 in. wide in the front. They are made of heavy gage sheet steel and are of welded construction.

Fixture Simplifies Tool Brazing

The "All-In-One" brazing fixture developed by T.C.M. Mfg. Co., First and Sussex Sts., Harrison, N. J., is claimed to simplify the brazing of any type of carbide tool. This fixture has four adjustable arms which hold ⅜-in. diameter carbon rods in position around the carbide tip. Carbon rods are used because they will not braze to the tip and because they will stand the brazing heat without perceptible deterioration. The top arm provides pressure on top of the carbide tip by means of a spring.



The flexibility of adjustment of the holding arms makes it possible to braze other small parts together easily.

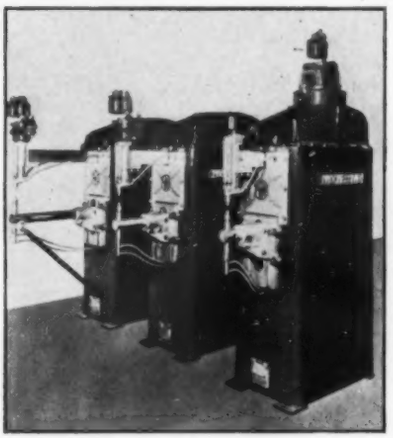
"Sturdybender" Brakes Offered in Small Sizes

A number of smaller "Sturdybender" bending brakes have been added to the line already manufactured by the Steelweld Machinery Sales Div., Cyril Bath & Co., Cleveland, Ohio. The new presses are suitable for handling up to No. 10 gage material in 10 ft. widths. They have a one-place all-welded frame, a heavy crown and heavy side housings. Slides are self-adjusting and self-compensating for

wear. A hollow bed is used, and these presses are especially suited for multiple operation for punching, notching, and other serial or separate operations.

"Multi-Duty" Welder Uses Sliding Contact

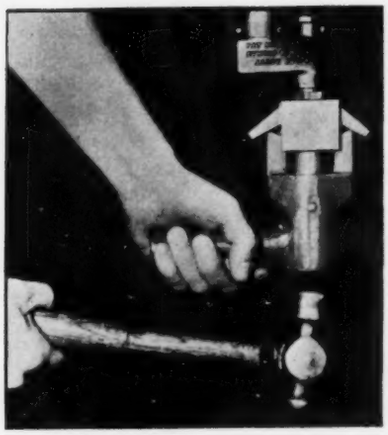
A welding head employing a sliding contact is used in the "Multi-Duty" spot welder announced by Progressive Welder Co., 737 Piquette Ave., Detroit, Mich. Solid arms are used in place of flexible connections and either air-hydraulic or pneumatic boosters are used for pressure application. Guns may be used individually or in multiple and may be mounted vertically, horizontally or at other angles. The arms can be moved up to accommodate work up to 36 in. deep, braces being available



for both the upper and lower arms when used at the maximum throat depth. Heat selection and timing controls permit an almost unlimited termination of single spot, multiple spot production welds. In the accompanying illustration, the welder at the left is a direct air-operated unit with the arms extended for deep throated work. The unit in the center also is direct air-operated, but is shown with the arms retracted. For heavier work, the machine at the right with arms fully retracted is used with an air-hydraulic booster.

Welder Point Puller Has Positive Grip

A taper point puller for multiple spot welders is offered by Progressive Welder Co., 737 Piquette Ave., Detroit, Mich. Puller provides automatic locking, positive grip, instantaneous operation, a straight-line pulling action and light weight. Design is such that there is no danger of damaging the welding point seat. The puller jaws are slipped over the electrode, a slight lift of the handle seats the jaws, and a tap of



the hammer on the bottom of the puller removes the electrode from the holder. Bell-mounting of the electrode socket is avoided by designing the puller so that it will be self-aligning in action.

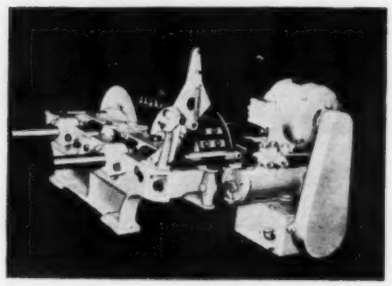
White Edger Protects Edges of Drawings

The "White Edger" developed by David White Co., Inc., 315 W. Court St., Milwaukee, Wis., uses a special binding tape, made of opaque white acetate fiber, to protect the edges of tracings and drawings which may be torn because of constant handling.

The tape is $\frac{3}{8}$ in. wide and is coated on one side with an adhesive so that it makes a permanent edge which will not curl or peel off. It is claimed that heat from the blueprint machine will not affect the tape. The tape used is made by the Minnesota Mining & Mfg. Co.

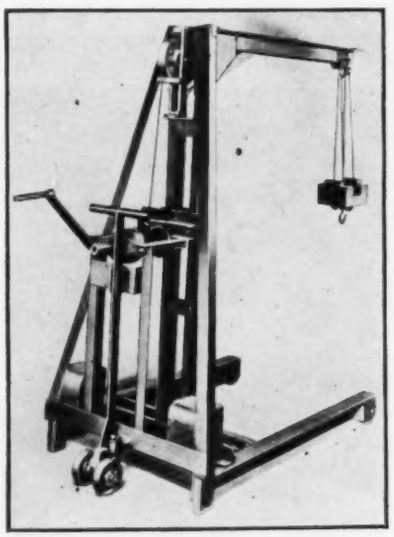
Hydraulic Control Is Automatic

An improved hydraulic automatic control for use with "Reeves" variable speed transmission units has been announced by Reeves Pulley Co., Columbus, Ind. With the "Reeves" transmission as a basis, this control provides entirely automatic feed regulation to make possible synchronization of different machines and separate sections of a single machine. Pressure of only 2 or 3 oz. will produce a change in speed. Backlash and lost motion are claimed to be eliminated, and liquid in the oil pump acts as a brake to prevent movement when the control is in the neutral position. The control is mounted at one end of the transmission frame, and a self-contained hydraulic power plant is mounted on the set of shifting levers of the transmission which control disk and belt diameters to effect speed changes.

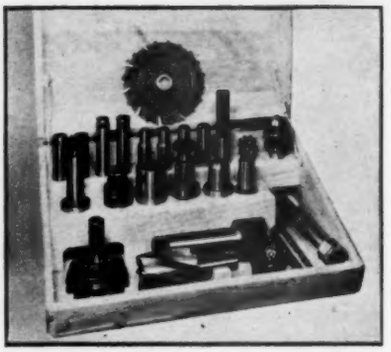


Portable Shop Crane Is Tailor-Made

Available either in hand or electrically operated models, this welded-steel portable shop crane offered by Barrett-Cravens Co., 3255 W. 30th St., Chicago, Ill., may be arranged with either fixed or revolving booms.

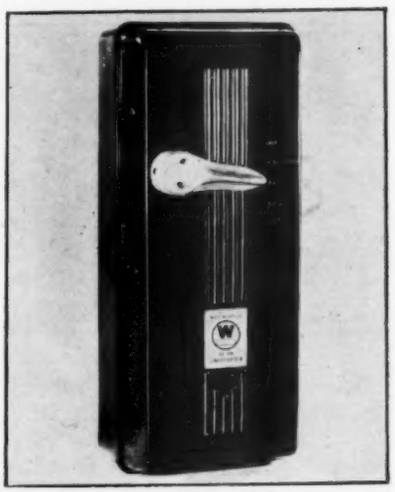


They are made in capacities ranging from 500 to 5,000 lb. and any lifting height desired is available. Every crane is tailor made to meet existing conditions.



Quick-Change Tool Set Available for Boring

A complete set of boring mill bars and adapters, known as the "Quick-Change" boring mill set, is offered assembled in a box of convenient size by the Modern Collet and Machine Co., Ecorse, Mich. All boring bars or adapters in this set can be interchanged in the chuck quickly. The main holder and all parts subject to axial and/or radial strains are made of high grade alloy steels and tempered to withstand severe shock loads. This equipment is readily adaptable to either boring or milling machines.



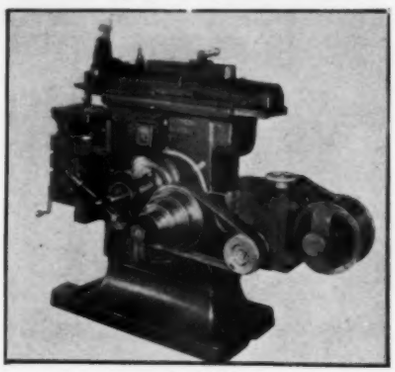
Combination Starter Requires No Fuses

An improved "De-ion" combination linestarter consisting of a magnetically operated linestarter and a manually operated motor circuit switch combined in the same cabinet, has been announced by Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. It is offered especially for across-the-line starting of squirrel-cage motors, or as a primary switch for wound-rotor induction motors. The

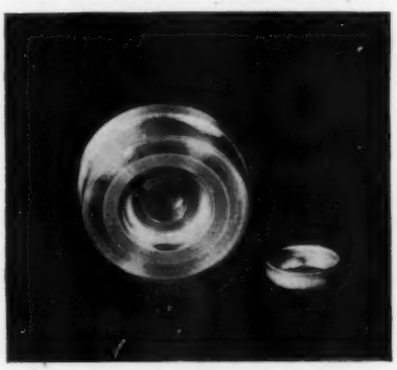
starter has fuseless circuit protection through an instantaneous magnetic trip circuit breaker.

Machine Drive Unit Has Variable Speeds

The "FlexoiD SPeed" control unit developed by the Smith Power Transmission Co., Penton Bldg., Cleveland, Ohio, is designed for use in arranging belt driven machines for motor drive. Single hand control is provided

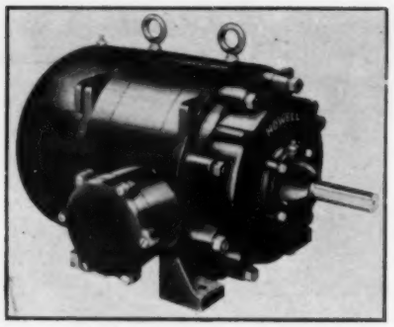


for all ratios and a neutral position is provided between each change of speeds. These units are equipped with ball bearings and will operate in two positions. A reverse with set ratio can be installed if desired.



Carbide Die Inserts Lengthen Die Life

A hard carbide insert for dies used in stamping and drawing automobile parts, chair casters, bottle caps, and other metal products, is offered by McKenna Metals Co., 103 Lloyd Ave., Latrobe, Pa. The die shown has stamped out 11,000 casters without visible signs of wear. In regular production runs Kennametal-faced dies have stamped out 70,000 casters before the first regrind. This can be compared with a total life of 14,000 pieces for the tool dies formerly used.



New Motors Are Explosion-Proof

The Howell Electric Motors Co., Howell, Mich., has announced an extension of its line of Type EKBB polyphase and Type EKCI single phase explosion-proof motors up to 40 hp., after having made these motors in sizes from ¾ to 10 hp. for a number of years. These motors are suited for operation in locations where inflammable liquids or gases are manufactured, handled or stored. They are totally enclosed. These motors carry the Underwriters' inspection label and are approved for all Class 1, Group D locations.

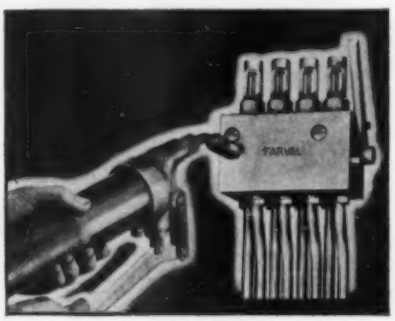
Pyrometer Controller Is Vibration-Proof

A vibration-proof "Celectray" indicating potentiometer has been developed by C. J. Tagliabue Mfg. Co., Park and Nostrand Aves., Brooklyn, N. Y. This instrument incorporates a damped photoelectric circuit which does not respond to abnormal disturb-

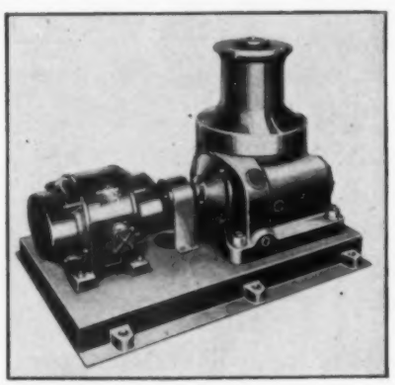
ance of the light beam. So far as vibration is concerned, the Model V controller acts somewhat as a filter, that is, the action of vibration upon the galvanometer cannot effectively be transmitted through the instrument to the control device.

Lubrication Unit Has Multiple Valve

Consisting of a multiple measuring valve block with a single inlet port and from two to eight lubricant outlets per block this control unit for positive pressure lubrication has been developed by the Farval Corp., Cleveland, Ohio. As many valve blocks as are necessary to lubricate all bearings on the machine can be installed and connected in series. The positive pressure lubrication of every bearing is accomplished by connecting a con-



ventional type of hand or power grease gun to the grease nipple at the inlet port and moving the rotary valve handle. Movement of the telltale indicator stem attached to each valve piston shows the oiler that each bearing has received its measured amount of lubrication.



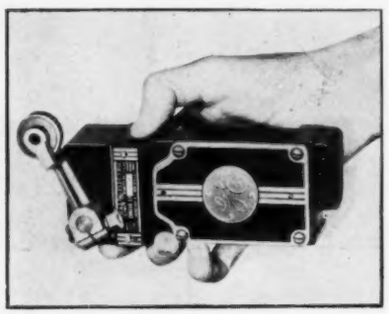
New Car Spotters Offered in Two Sizes

For economically spotting railroad cars for loading or unloading, the Link-Belt Co., 307 N. Michigan Ave., Chicago, Ill., has developed the No. 5-A and No. 10-A vertical-capstan electric car spotters which employ a high torque electric motor connected to the spotter drive mechanism by an encased flexible roller chain coupling. The No. 5-A spotter is

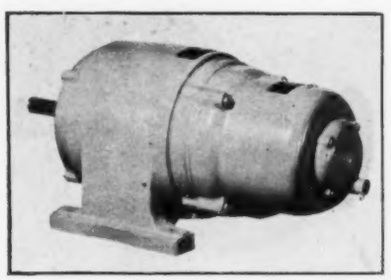
equipped with a 5-hp. motor and will move one to three cars, depending upon track conditions. It has a pull of 5,000 lb. Requiring a 10 hp. motor, the No. 10-A machine will move from three to six cars and has a pull of 10,000 lb.

Small Limit Switch Has Snap Action

Designed for use on machine tools, conveyors and other automatic equipment, the small No. CR-9440-D2 snap-action limit switch, announced by General Electric Co., Schenectady, N. Y., is so constructed that it can



be mounted for operation in practically any position. Silver-to-silver double-break contacts are used, and two independent circuits provide any contact arrangement. The switch can be supplied with either a roller-lever or push-rod head.



Frequent-Reverse Motor Announced by Sterling

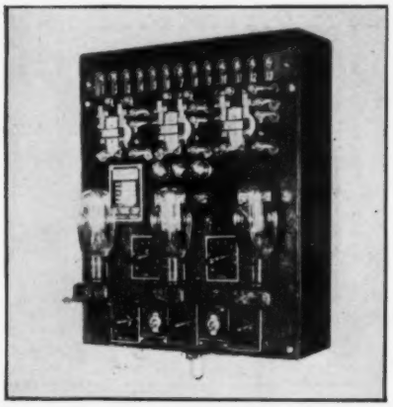
Designed to stand up under frequent reversals, as high as one reversal per second, at full voltage without undue heating or deterioration, this squirrel cage motor offered by Sterling Electric Motors, Inc., Telegraph Road at Atlantic Blvd., Los Angeles, Calif., is continuously ventilated. Forced ventilation is provided by small auxiliary motor and squirrel cage fan at one end of the motor. Stator windings are micabestos insulated. These motors are available in a number of sizes and speeds up to 10 hp.

"Floating" Lamp Units Are Fully Adjustable

Both arms of the "Floating" lamps offered by Dazor Mfg. Corp., 4485 Duncan Ave., St. Louis, Mo., are balanced in all positions by a spring. Concentrated local lighting can be provided on the work in almost any direction. The double-lamp arm permits any horizontal or vertical adjustment while a double swivel at the lamp socket permits angular adjustment of the light. Pivoting of the lamp to the base permits the entire lamp to be rotated horizontally in a complete circle.

Timers Control Welding Operations

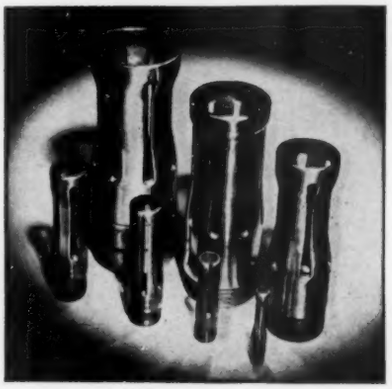
A line of electronic welding timers designed for use with gun, spot, projection and automatic welding equipment has been announced by Weltronic Corp., Detroit, Mich. The



line comprises models ranging in application from single spot to multiple automatic spot welding. Up to 600 spot welds per minute have been made in regular production with these timers. Welds in sections up to ½-in. thick can be controlled successfully. Standard relays and electronic tubes are used.

Bar-Stock Pushers Offered in Bronze

Claimed to be particularly suited for any work where scratching must be eliminated, standard-design pushers made of a special bronze are offered



by the Modern Collet and Machine Co., Ecorse, Mich. The bronze used is claimed to retain, at all times, the proper spring tension necessary for correct feeding. Only one pusher is needed for round and hexagon stock, and one is required for round and square stock. They have a long, flat grip surface and can be tightened, when they become loose, without the aid of special tools.

New "Thor" Drill Has ¼-In. Capacity

The "Thor" light-duty ¼-in. capacity electric drill announced by the Independent Pneumatic Tool Co., 600 W. Jackson Blvd., Chicago, Ill., weighs only 4 lb. and is 12-in. long, overall. It is a light-duty tool designed for general intermittent service in maintenance and installation work. This "Drillmaster" drill has a speed of 2,000 r.p.m.

MORE THAN 41 Years OF DOING ONE THING WELL

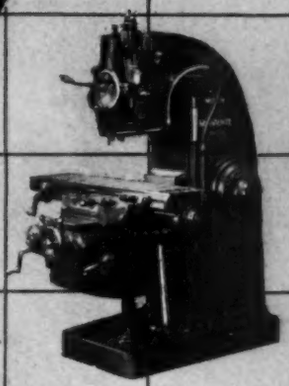
1899
12 EMPLOYEES

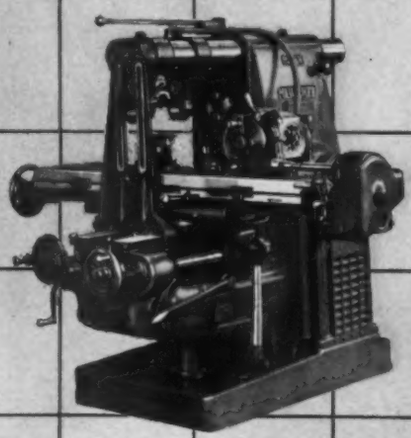
1909
151 EMPLOYEES

1919
653 EMPLOYEES

1929
904 EMPLOYEES

1939
1352 EMPLOYEES





Early in its business life, Kearney & Trecker Corporation included among its products lathes, boring bars, grinders, special machine tools, etc., . . . but soon discovered that if they were to excel, it would be necessary to concentrate their efforts upon one product. The soundness of this policy has been demonstrated.

KEARNEY & TRECKER CORPORATION
MILWAUKEE, WIS., U. S. A.

MORE THAN 41 years OF DOING ONE THING WELL

K&T

Milwaukee MILLING MACHINES

Duplex Welding Hose Offered by Manhattan

The "Condor" duplex welding hose, developed by the Manhattan Rubber Mfg. Div., Raybestos-Manhattan, Inc., Passaic, N. J., incorporates two hose lines which are held together by a permanent web joint integrally molded and claimed to have high strength and flexibility. The joint prevents tangling, kinking and snagging while the hose is in use. The ends are separated 18 in. for the torch end, and 24 in. for the tank end for ease in making connections and in handling. Covers are furnished corrugated and colored red and green to distinguish the oxygen from the acetylene line.

"Readyweld" Electrodes Has Heavy Coating

Intended for general welding and repair work on light gage sheet steel, the "Readyweld" arc welding electrode announced by the Lincoln Electric Co., 12818 Coit Road, Cleveland, Ohio, was developed for use with a.c. transformer-type welders. This electrode is a low-carbon steel rod with a heavy extruded shielded arc coating possessing properties which are claimed to assure arc stability and easy restriking of the arc with small low-voltage welders. The electrode provides weld metal which possesses high strength and ductility. It is manufactured in $\frac{5}{32}$-in. diameter, 12-in. lengths.

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Low-Bake Enamel Speeds Up Production

Low-bake "Dulux" enamel for industrial finishing, announced by The Finishes Div., E. I. du Pont de Nemours & Co., Inc., Room 7156 du Pont Bldg., Wilmington, Del., is claimed to speed up production in low-temperature ovens. It affords the following baking schedules: One-quarter hour at 250 F.; ½ hr. at 225 F.; 1 hr. at 200 F.; and 2 hr. at 175 F. This finish is claimed to have good gloss and build, print resistance, and retained flexibility. It is wrinkle-proof under all normal conditions. Satisfactory hiding is provided with one coat when applied on solvent-cleaned steel, bonderited steel or primed steel. White and colors are available.

Electrode Dressers Are Air Operated

Welding electrodes may be dressed without removal from spot welders with air-operated hand dressers introduced by the Progressive Welder Co., Detroit, Mich. These "Presto" dressers are operated by attaching directly to regulation shop compressed air line. They are available in both a flat-plate and a "shank" type. The former is designed for use where there is restricted space between electrodes but, like the shank type, may be used for all other welding electrodes applications. Interchangeable blades are provided to dress dome-shaped as well as long and short taper crowned points. They are made for various standard point sizes.

Fluorescent Lamp Rated at 40 Watts

The "Hygrade" 40-watt Type T-12 fluorescent lamp offered by Hygrade Sylvania Corp., Salem, Mass., is 48 in. long and 1½ in. in diameter. This lamp supplies 35 lumens per watt and is available in daylight and warm white colors only. This size of lamp takes a special auxiliary.

TRADE PUBLICATIONS

BOX TOOLS A leaflet issued by the Banner Mfg. Co., 1873 Clybourn Ave., Chicago, Ill., provides specifications of a line of roller bearing box tools for use on Brown & Sharpe automatic screw machines.

BURRS The Stow Mfg. Co., Binghamton, N. Y., illustrates an extensive line of burrs in a four-page supplement to its catalog of standard flexible shafts and flexible shaft equipment.

CARBIDE An 18-page illustrated booklet published by the Tungsten Electric Corp., 540 39th St., Union City, N. J., discusses the use of "Teco" metal for cutting tools, wearing parts and wire-drawing dies. Included are six pages of tables providing detailed specifications for many types of cutting tool applications.

CONTROLLERS "Temperature Controllers," a 48-page illustrated bulletin, No. 225, published by the Foxboro Co., Foxboro, Mass., discusses factors governing the choice of temperature controllers aud outline types of air-operated controllers to meet particular industrial needs.

COMPRESSORS A 28-page illustrated catalog, Form 3063-A, issued by the Ingersoll Rand Co., Phillipsburg, N. J., describes the "ES" line of compressors, available in sizes ranging from 10 to 125 hp. and in pressures from 5 to 2,500 lb.

CONVEYORS The Mathews Conveyer Co., Ellwood City, Pa., has published a 384-page handbook showing standard and special types of conveyors. This catalog, No. HB39, is offered to plant engineers and operating men when requested on company stationery.

DIAMOND WHEELS A folder describing diamond wneels for grinding cemented carbide is now being distributed by the Norton Co., Worcester, Mass.

DIESELS Type CC direct-injection four-cycle diesel engines are described in Bulletin No. S-500-B36, published by the Worthington Pump & Machinery Corp., Harrison, N. J.

GASKETS Goetz Gasket & Packing Co., New Brunswick, N. J., has issued a pamphlet including specifications of metal jacketed and spiral wound boiler gaskets for manholes, handholes and tube caps of all standard makes of boilers.

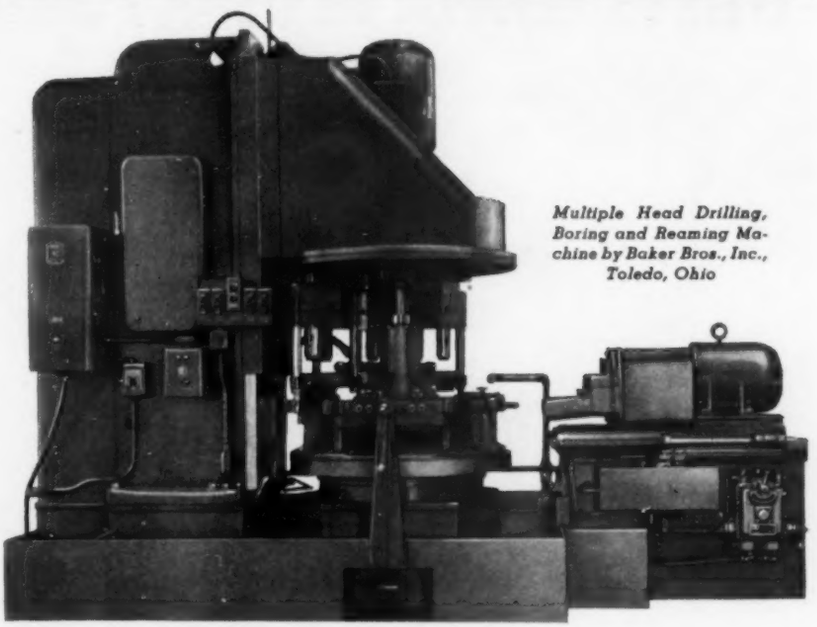
GEARMOTORS "Barcol" geared-head motors for fractional horsepower applications are described in data sheet No. M-31, issued by the Barber-Colman Co., Rockford, Ill.

LIGHTING "Lighting for Production in the Factory," a 40-page illustrated booklet published by the Nela Park Engineering Dept., General Electric Co., Cleveland, Ohio, discusses modern methods of light measurement and provides engineering data covering many units specially designed for industrial applications.

MATERIALS HANDLING Form No. G1–39, now being distributed by the Cleveland Crane & Engineering Co., Wickliffe, Ohio, illustrates features of the Cleveland Tramrail overhead materials handling system.

MEASURING TOOLS Van Keuren Co., 12 Copeland St., Watertown, Mass., has published a 28-page catalog, No. 30, describing an extensive

LET OILGEAR FEEDS SOLVE THAT STUBBORN PROBLEM



Multiple Head Drilling, Boring and Reaming Machine by Baker Bros., Inc., Toledo, Ohio

The range of Oilgear Fluid Power Feed applications is so broad, the type of machine and machine tool problems they can solve is so varied, that we gladly extend an invitation to every designer with a stubborn power problem on his hands to counsel with our engineers.

Forget the usual limitations on power applications; forget the conventional do's and don'ts, see what Oilgear Fluid Power Feeds can offer you before you say it can't be done. If it's greater speed, better control, simpler design, stepped-up production, reduced tool breakage, or lower material and tool costs you're after, put it up to Oilgear. Even the tough jobs are often simple the Oilgear way. Write and see. THE OILGEAR COMPANY, 1309 West Bruce Street, Milwaukee, Wis.

OILGEAR
FLUID POWER FEEDS

line of precision measuring tools. Included are features of new light wave measuring equipment, light wave micrometer, measuring wire, gage blocks and thread gages.

MOTORS Leaflet No. 2125-C, issued by the Allis-Chalmers Mfg. Co., Milwaukee, Wis., features a line of explosion-proof motors. Leaflet No. 2183-A discusses the Type E "Low Maintenance" d.c. motors and generators.

PRECISION LATHES Bulletin No. 11 D, published by the South Bend Lathe Works, 279 E. Madison St., South Bend, Ind., describes the Series R 11-in. swing precision lathes.

PUMPS The Worthington Pump and Machinery Corp., Harrison, N. J., describes a line of turbine-driven centrifugal pumps in Bulletin No. W-321-B3.

STANDARDS Form No. 3901, issued by the American Standards Association, 29 W. 39th St., New York, N. Y., comprises an indexed list of American standards and safety codes.

TOOLROOM MACHINE The Gilman 4-in-1 toolroom machine, combining the features of a precision lathe, sensitive drill, horizontal mill and vertical mill, is described in a folder issued by the Gilman Engineering Works, Janesville, Wis.

TUBING TOOLS A line of cutters for burring, reaming and facing tubing is described in Bulletin No. 12-T, released by the Severance Tool Mfg. Co., 1524 E. Genesee Ave., Saginaw, Mich.

UNIVERSAL JOINTS Catalog Ind. 1939, published by the Mechanics Universal Joint Div., Borg-Warner Corp., Rockford, Ill., contains 12 pages describing roller bearing universal joints and flexible drive shafts for various industrial applications.

VALVES Features of the "Duravalve" line of valves for high temperature and high pressure applications are discussed in an illustrated bulletin offered by the Hancock Valve Div., Manning, Maxwell & Moore, Inc., Bridgeport, Conn.

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You don't need to use a mirror or resort to awkward positions when using the Lufkin Universal Indicator. It has two reading faces so that you can easily take readings direct from the tool, no matter how it is used.

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TAPES — RULES — PRECISION TOOLS

SEEN and HEARD

JOHN R. GODFREY

No "Must" in Threads

Ultimatums are bad medicine, whether in labor differences, business practices or the adoption of new standards. It's always well to leave a loop hole for compromise without losing face. It's particularly true in the case of standards, the Screw Thread Standards being a good example.

No one claimed they were perfect. But if there had been a "must" tacked to it, rebellion would have flared in many quarters. As it is the new sizes and designations have been very widely accepted. Numbered sizes are rarely called for above No. 12. Above that, fractional sizes are now almost universal.

Thrift!

In New England, "thrift" was one of the first words in the vocabulary to be emphasized; but as generally used it means saving instead of spending—which may often be a real boomerang. If every one in your town saved a dollar a day that they now spend, what would happen to your business? What if every user of whatever you make decided to make the old one run another year?

You might think of this when you are debating whether to make that old drill press or lathe do duty until 1940. Real thrift isn't just squeezing pennies or even dollars. It is in investing as much as your exchequer will allow in new things that will give you increased returns in production, quality of product—or in personal satisfaction. Sometimes dividends in satisfaction are worth more than any other kind.

Inspection Gone Wild

There seems to be an excellent example of the old adage "a little knowledge is a dangerous thing" in the recent specifications for aircraft instruments. One of these, written I am told by a reserve officer and not a West Pointer, calls for 100 per cent inspection of each operation in the making of the parts for the instruments. Estimates as to the cost of this runs up to startling figures. With this specification strictly enforced the cost of manufacture can easily be increased from four to six times.

With modern machine and tooling methods, no such inspection is needed, nor would it produce better mechanisms. Proper functioning is assured by a reasonable inspection of parts in process and complete inspection of the functioning of each unit or complete mechanism.

Machine Shop Training

By C. G. WILLIAMS

In the article by Samual Gahan (*AM*—Vol. 83, page 74) is the statement: "One wonders just how long it should take to train a boy to hold a job."

There are several "ifs" attached to this question. It would take some boys several lifetimes of the biblical three score years and ten, to make even half-way machinists; others can hold a job after three months.

I have had considerable experience in handling boys and young men. Back in Bridgeport, in 1914, that city had the best vocational training school system in the United States; yet the boys who "graduated" could not hold jobs in any establishment. I do not know of a boy who graduated during a two-year period who was not fired several times, after from one week to three months on initial employment.

On the other hand, farmer boys of the same age learned the rudiments of a machine operator's job in from one day to three weeks, some boys even moving from one to three machines in a month. One farmer boy, who claimed he was nineteen while only fifteen years old, made a reliable cartridge drawing press repair man in three months and today is general manager of a large plant.

In a western railway round-house, when mechanics were not available, farmer boys were taken on and made all-around locomotive repair men, who could operate a drill press and lathe within the scope required of a round-house mechanic in six months. Three of them, while I was away, undertook to straighten a bent main rod and did a creditable job after having had only three months' work. Two of them had helped me do a similar job on their first day's work in the shop. Of the 52 boys employed in that round-house, over a period of eighteen months, sixteen because of their record, were advised to quit and go to another railroad, which also wanted mechanics, as the company would not increase their pay commensurate with their advance in knowledge. They were paid first class mechanics' wages in the second round-house, and that after a period of from three to six months' work.

We must remember that no two

The New 2½′ Super-Service Radial

Offers advantages of size, economy, ease of handling, power and floor space savings, and the adaptability of pick-off gears. Designed especially for production drilling, tapping and reaming of holes up to ¾″ diam. in steel or 1″ in cast iron, every feature to promote fast, easy handling, long life and safety is incorporated. Write for Bulletin R-26 giving complete information.

THE CINCINNATI BICKFORD TOOL CO.
OAKLEY CINCINNATI OHIO U.S.A.

boys or men have the same capacity for absorbing knowledge. I have seen boys, who, after four years of apprenticeship work, where advance was automatic and not according to ability, who could not set up a piece of work in a shaper without asking questions. Another boy could do it after the first day.

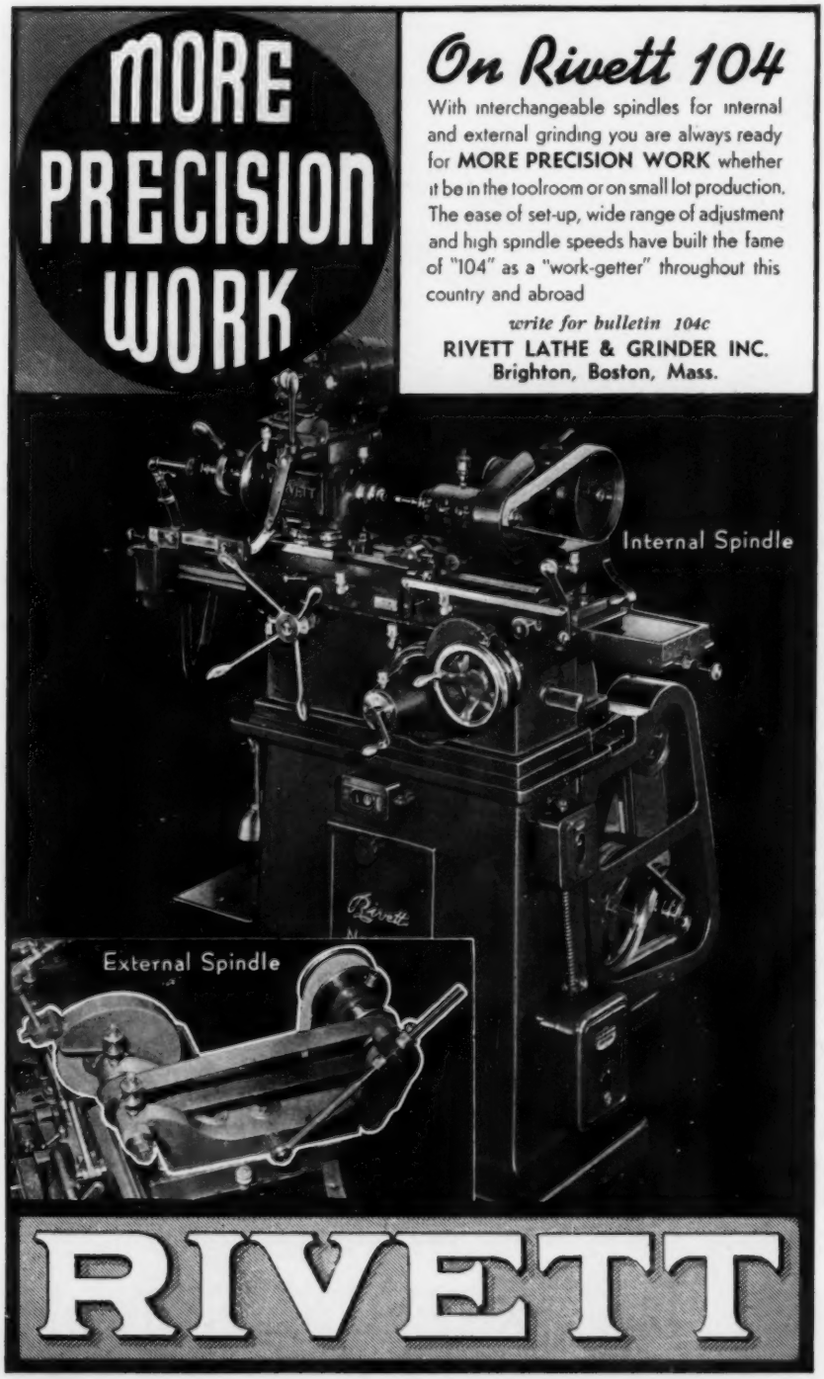
I have never seen a boy, a graduate from a high school-vocational training school, who could handle any job in a shop until after much training, far more than a farmer boy would need. The vocational-school trained boy has no responsibility and is more inclined to play than to work. It is getting worse every day, between fathers and mothers wanting them to wear white collars and fanatics wanting them to do no work until they are eighteen to twenty years of age.

In connection with this, I would like to ask why it is that of a family of four boys, one should be a drunkard and bum, one a sailor, one a half successful doctor and one an eminent scientist. If you can answer that you should be able to tell me why we should ask all boys to submit to a four-year apprentice training course when one will be better fitted in two years to go out than another boy would in four years.

Of the 52 boys mentioned above, one is a master mechanic, nine are foremen, twenty-one have their own garages, seven went back to the farm, seven are dead, one has not been heard from for years, one is a petty union organizer, one has a cattle ranch in South America, two are on W. P. A., one is a contractor on steel bridges and one a civil engineer.

And so, why should we not, in a school or in the shop, rate a man or boy on his ability. Life does that very thing.

Some men are born teachers; others can neither teach nor learn.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Magnaflux For Improvement

By ED WEST

"You know, the trouble with most people is that they consider Magnafluxing only as a very critical form of inspection. As a matter of fact, it is worth more as an aid to product development and production savings."

This was from one of the men who has worked with Magnaflux inspection from its early inception. He showed us some examples right in his own shop where the method was used to check shop processes rather than as an inspection method.

There were some integral pinions and shafts for engines which were failing in service and a change in material or heat treatment was being considered. Magnaflux inspection after a few hours run showed minute fatigue lines running from the bottom of the teeth down to the shaft. Once this condition was definitely known a larger fillet between pinion and shaft section was the only change necessary in the design.

In another case failures in drawn metal parts were eliminated by decreasing clearances in a die after Magnafluxing had indicated the location and direction of fine cracks in the formed part. Continued experiment in this case also indicated that rejections could be decreased if the forming temperatures were raised considerably above the average room temperature.

Certain expensive propeller parts were being rejected because of the appearance of surface cracks. No one dared accept the parts because of the possibility of fatigue failures. However, by grinding off a few thousandths and checking again by the critical Magnaflux it was proven that these cracks had been removed in grinding and were safe to use, thus saving a lot of expensive parts.